WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

JULY 1951

Centrifuges at Hiram Walker's Canadian Plant

CHAPMAN *Standardized* SLUICE GATES

Use Chapman *standardized* Sluice Gates and you'll find installation is easier — maintenance is easier — costs lower.

Why? Well consider the stems and couplings — they're completely interchangeable so that match marking is never necessary. And all the other parts are as carefully made. As a result repair and replacement parts drop easily into place — never require field alteration.

Chapman Sluice Gates can be obtained with any type of operating control — manual, hydraulic, cylinder or electric motors. Write for Bulletin No. 25 for handy tables and more detailed information.

For special jobs, our engineering staff is at your service.

THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASSACHUSETTS

NEW TYPE STRAIGHT READING METER REGISTER

MANY ADVANTAGES OFFERED

A great many water works men prefer the straight reading or cyclometer type of water meter register due to the ease and accuracy with which it can be read. But the design of straight readers produced in the past has been such that they have frequently proved troublesome and unreliable in service. All these difficulties have now been overcome according to engineers at Rockwell Manufacturing Company, by a revolutionary new register design.

Mechanical Features

In the new Rockwell straight reading register the number wheels are recessed to receive the pinions, thus making it impossible for the pinions to get out of line and bind. The wheels themselves are of heat proof plastic. These wheels are also impervious to corrosive attack. The numerals are impressed in black against a white background to provide good visibility. The dial plate is made of stainless steel with all indications permanently etched into the surface. This stainless steel plate will not chip, crack or discolor.

Easy to Reset

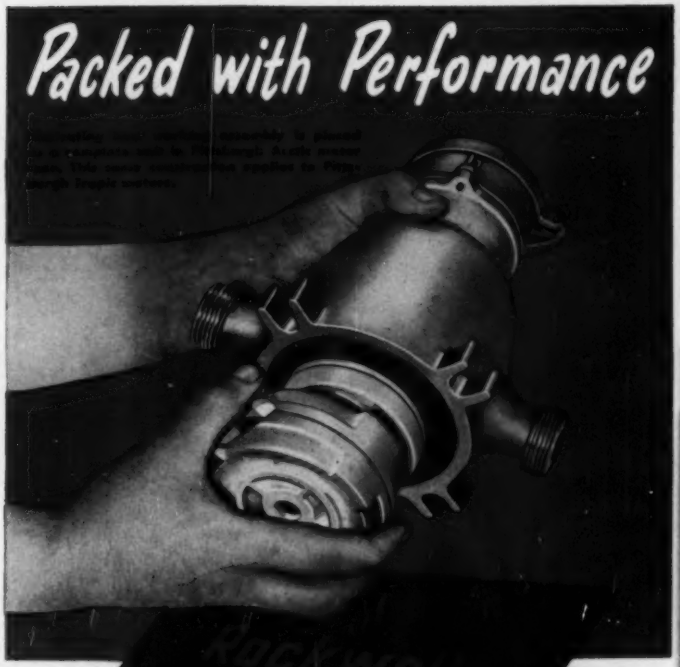
One of the important features of this register design is the ease with which the numerals can be returned to zero. This is desirable when reconditioned meters are put back in service to simplify record keeping during the life of the meter.

To reset the Rockwell register it is only necessary to remove a simple spring clip after which the pinion and number wheel shafts will easily slide through the brackets to return to the zero reading.

Large Red Test Hand

The Rockwell straight reading register is fitted with a large red center test hand that sweeps the entire outer circumference of the dial face. This large hand aids in calibrating meters and detecting small flows. It also may be used to demonstrate leaky fixtures to doubtful consumers.

Any domestic size Rockwell meter (Empire, Arctic or Tropic) can now be furnished with this new straight reading register upon specification. It is also available for parts replacement.



Pittsburgh disc meters are precision built to keep the performance standards that have been so carefully engineered into them. Step by step—from controlled casting . . . through accurate machining and expert fitting—to exacting tests—Pittsburgh disc meters are *made right to measure right!* In addition, the unit assembly of working parts assures a free running mechanism that years hence can be repaired or replaced with minimum trouble and expense. Get all the facts about Rockwell disc meters now. *Write for catalog.*

Rockwell
MANUFACTURING COMPANY
PITTSBURGH 8, PA.

Atlanta Boston Chicago Columbus
Houston Kansas City Los Angeles New York
Pittsburgh San Francisco Seattle Tulsa

Again...

Sanitation HTH is available in cases of nine handy 5-lb. cans and in 100-lb. drums.

SANITATION HTH... HELPS OUT IN A JAM

A nine-day flood—the result of a heavy ice jam on the Susquehanna River—completely inundated the water works of Columbia, Pennsylvania. In this situation, as in hundreds of similar emergencies, Sanitation HTH was successfully called upon to help maintain a supply of pure water while the regular pumping and chlorinating system was inoperative.

Whether for emergency applications or for your daily sanitizing tasks, you can rely on this ever-ready source of chlorine. Dry, free-flowing and granular, Sanitation HTH is extremely easy to store and to apply—especially handy for sanitizing those hard-to-get-at spots.

Play it safe—keep a stock of this reliable hypochlorination agent handy. And for full information about how you can best use Sanitation HTH write for a copy of "Hypochlorination of Water." Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

Mathieson
CHEMICALS

9092

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

Water and Sewage Works. Reg. U. S. Patent Off. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Entered as second class matter Mar. 4, 1948, at the post office at Mount Morris, Ill., under Act of Mar. 3, 1879. For subscription rates, see Contents Page.

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

COMING ARTICLES

"Regulation and Diversion of Utility Funds," always an important topic, is disscussed by R. E. Donnell of Kansas City . . . "Unaccounted-for Water," by Homer Beckwith of Pittsburgh, contains some new slants on this critical subject . . . "Leak Location on a Sub-aqueous Intake Line" by Geo. Hazey of Wyandotte, Mich., describes an ingenious method . . . "Corrosion of Cement-bonded Sewer Pipe by Acid and Alkali," by Prof. Harvey Ludwig of California, reveals experimental observations and findings . . . "Water Pollution Control" is an interesting discussion by Hess of National Analine . . . Prof. Poepel of Stuttgart, Germany, answers critics of his proposed method of "Settling Tank Design" published in this magazine . . . "Dispersion of Leaking Chlorine with Fire-fighting Fog Nozzles," by Hopkins and Faber, relates Baltimore experiences.

E. S. GILLETTE, Publisher
L. H. ENSLOW, Editor*

Managing Editor
GEO. E. SYMONS, PH.D.

Assistant Editor F. C. MAURER
Make-Up Editor W. W. VANSTONE

Editorial Associates
J. R. BAYLIS
A. M. RAWN
H. A. FABER

EXECUTIVE OFFICE
22 W. Maple St., Chicago 10, Ill.
H. P. GILLETTE, Pres.
E. S. GILLETTE, Vice Pres.
Advertising Director
H. J. CONWAY
Representatives
M. B. Nylund R. T. Wilson

EDITORIAL OFFICE
155 E. 44th St., New York 17, N.Y.
LINN H. ENSLOW, Vice Pres. & Editor
GEO. E. SYMONS, Managing Editor
F. C. MAURER, Ass't. Editor

BUSINESS OFFICES
New York Office
155 E. 44th St.
H. D. Crippen, Mgr. F. A. Michel

Cleveland Office
Leader Bldg.
Lee B. McMahon, Mgr. Wm. P. Saunders
Wm. O. Harrah

Pasadena Calif., Office
1126 Del Rey
John A. Osborne

*Member

VOL. 98 **July, 1951** No. 7

Water Treating Experiences (Part VI) 283
By A. H. Ullrich, *Austin, Texas*

Graphical Approach to Statistics (Part V) 289
By C. J. Velz, *Ann Arbor, Mich.*

Design of Main Extensions of Small Size 294
By D. R. Taylor, *Baton Rouge, La.*

AWWA Management Division Session at Miami 298

Corrosion Control at New Haven, Conn. 304
By Marshall Wellington, *New Haven, Conn.*

120th Anniversary of Philadelphia Quartz 307

M.C.A.'s 5th Conference on Pollution Abatement 308

Treatment of Distillery Wastes 312
By C. T. Carson, *Walkerville, Ont.*

Sewage Works Program of Wilmington, Delaware (Part I) 318
By A. R. Vollmer, *Baltimore, Md.*

Sixth Purdue Conference on Industrial Wastes (Part III) 325

"Meetings Scheduled" 84A

Here and There with Doc Symons 86A

Manufacturers' and Equipment News 92A

Literature and Catalog 106A

Water & Sewage Works is indexed regularly by Engineering Index, Inc.

Published Monthly—subscriptions in the U.S., Canada and Latin America $2.00 per year; Foreign $3.00. Single copies 25c.

(Member—Audit Bureau of Circulation and Associated Business Publications, Inc.)

The STRENGTHS you need

The strengths demanded of pipe to be laid under expensive modern pavements, if costly repairs and replacements are to be avoided, are known strengths—proved by experience and determinable by tests. The four strength factors that pipe must have to withstand beam stresses, external loads, traffic shocks and abnormal working pressures are listed on the opposite page. *No pipe, deficient in any of these strength factors, should ever be laid in paved streets of cities, towns or villages!* Cast iron water and gas mains, laid over a century ago, are serving today in the streets of 30 or more cities. These service records prove that cast iron pipe not only resists corrosion but has all the vital strength factors of long life and economy.

CAST IRON PIPE

in pipe for city streets . . .

No pipe that is deficient in any of the following strength factors should ever be laid under paved streets.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

SERVES FOR CENTURIES

HOW TO *Tame* A TIGER!

Sewage sludge gas is like a tiger in one respect — both are dangerous if they get out of hand. P. F. T. Gas Safety Equipment "tames" sewage sludge gas — renders it "gentle as a kitten" — and useful too.

Whether sewage gas is utilized in gas engines for power, wasted without odor by burning in a P. F. T. Waste Burner or used for Digester and building heating with a P. F. T. Digester Heater, there is a P. F. T. Epuipment to safeguard against every contingency that might arise in handling sewage sludge gas.

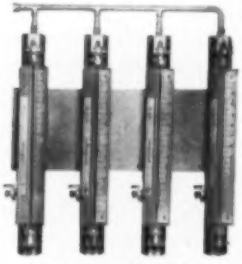
Model 91 Flame Trap

P. F. T. Gas safety Equipment includes Combination Pressure Relief and Waste Gas Flame Trap Units, Flame Traps, Waste Gas Burners for exterior use, Pilot Line Flame Cells, Low Pressure Check Valves, Gas Pressure Regulators, manually operated Drip Traps, Accumulators for Condensate and Sediment, Gas Pressure Indicating Gauges, and auxiliary safety equipment such as Digester Floating Cover Position Indicators. Every unit service-proved in numerous installations — sound engineering evident throughout the line. Typical gas piping arrangements are detailed in Bulletin 221.

Waste Gas Burners

Model 92 Pressure Relief And Regulator Valve

Manually Operated Drip Traps



Gas Pressure Indicating Gauges

Digester Floating Cover Position Indicators

Low Pressure Check Valves

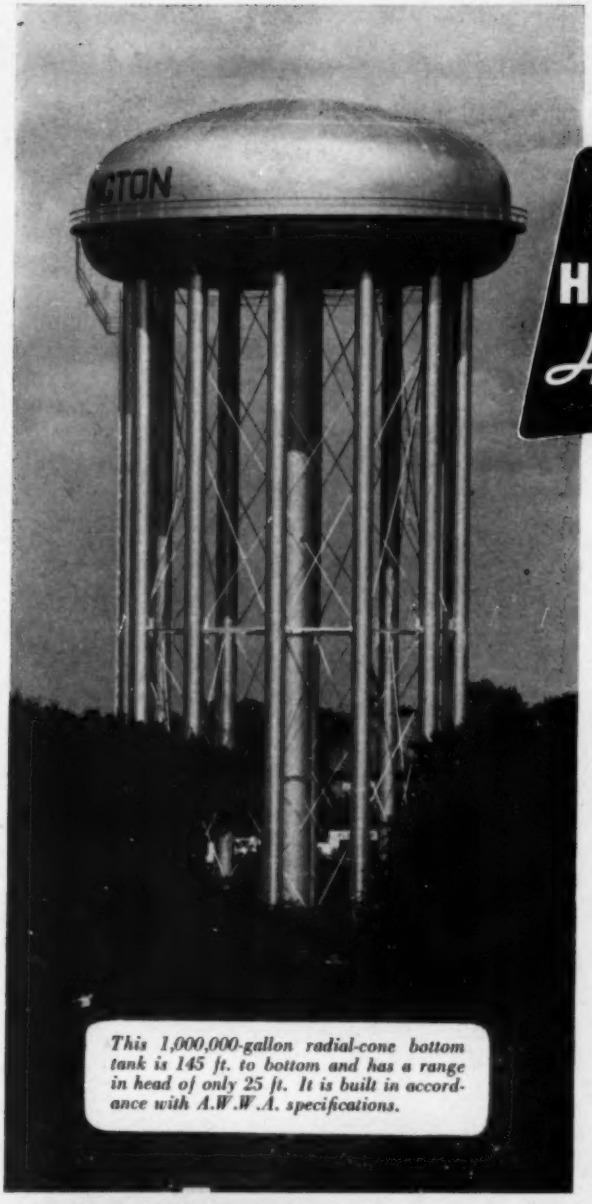
Condensate and Sediment Accumulators

P.F.T. PACIFIC FLUSH TANK CO.

Waste Treatment Equipment Exclusively Since 1893

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER



This 1,000,000-gallon radial-cone bottom tank is 145 ft. to bottom and has a range in head of only 25 ft. It is built in accordance with A.W.W.A. specifications.

Another Horton Tank in *Hoosierland*

HERE is another shining addition to Indiana's growing family of Horton elevated water tanks. It's the new 1,000,000-gallon installation at Huntington. Rising above this city of 18,000 people, it signifies dependable water service for years to come.

As many cities have discovered, elevated storage results in three important advantages . . . increased water pressure . . . decreased pressure variations . . . and reduced pumping costs. Combine these important features with modern appearance and it's understandable why so many cities in Indiana, and throughout the country, are installing Horton Tanks for municipal service.

The radial-cone bottom design of the Huntington installation was developed especially for large capacity tanks. It enables us to build elevated tanks up to 3,000,000-gallon capacity with a range of 25, 30 or 35 ft. between the upper and lower water levels.

Horton water tanks are of welded construction for lower maintenance costs and longer life. Smooth surfaces are easier to paint thoroughly and the protective coating is more effective.

Horton tanks with radial-cone bottoms are built in standard capacities ranging from 500,000 to 3,000,000 gallons.

Write our nearest office today for complete information.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3	2181 Healey Building	Los Angeles 14	1565 General Petroleum Building
Birmingham 1	1586 North Fiftieth Street	New York 6	3390-165 Broadway Building
Boston 10	1048-281 Devonshire Street	Philadelphia 3	1644-1700 Walnut Street Building
Chicago 4	2199 McCormick Building	Salt Lake City 4	560 West 17th South Street
Cleveland 15	2262 Guildhall Building	San Francisco 11	1583-200 Bush Street
Detroit 26	1551 Lafayette Building	Seattle 1	1350 Henry Building
Havana	402 Abreu Building	Tulsa 3	1646 Hunt Building
Houston 2	2115 National Standard Building	Washington 6, D.C.	1109 Cafritz Building

Designs from engineers' notebooks

screen chamber with EVERDUR screens

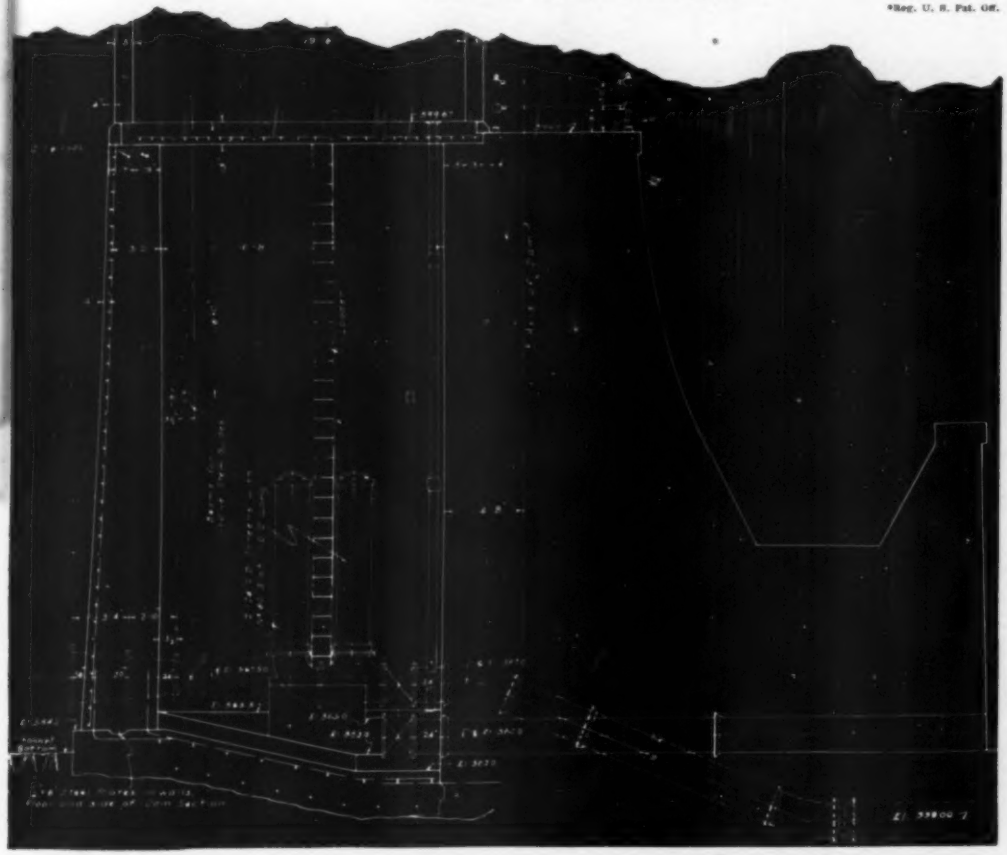
This water supply screen chamber and intake was developed by Malcolm Pirnie Engineers of New York. Advantages of this design are simplicity, complete absence of moving parts, use of standard Everdur* well screens and use of hydraulic backwash to clean the screens.

The use of Everdur for screens promises long screen life with a minimum of maintenance.

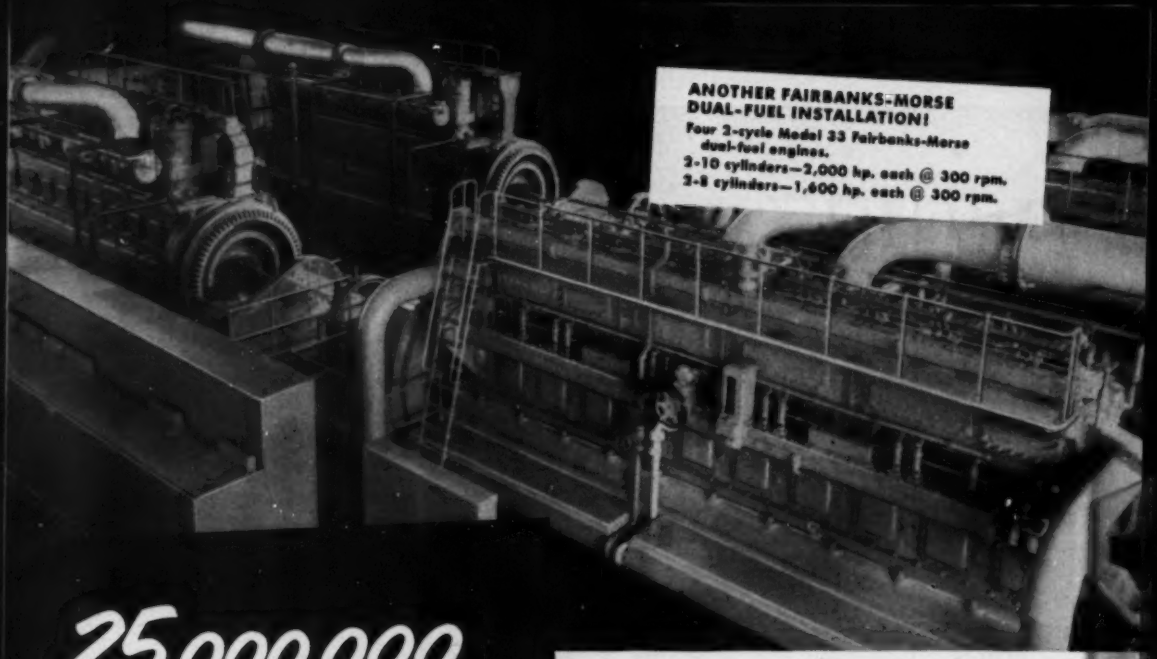
Everdur copper-silicon alloys provide an ideal structural metal for waterworks and sewage installations and wherever rust and corrosion are problems. They are strong, highly resistant to fatigue and easy to fabricate by oxyacetylene and electric welding into low cost, lightweight wrought metal assemblies.

Anaconda Technical Department engineers will gladly advise you on translating your designs into Everdur. Write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 51143

*Reg. U. S. Pat. Off.



where corrosion resistance counts—consider **ANACONDA®** COPPER-SILICON ALLOYS



ANOTHER FAIRBANKS-MORSE DUAL-FUEL INSTALLATION!

Four 2-cycle Model 33 Fairbanks-Morse dual-fuel engines.
2-10 cylinders—2,000 hp. each @ 300 rpm.
2-8 cylinders—1,600 hp. each @ 300 rpm.

25,000,000 LOW COST Kw-h per YEAR with FAIRBANKS-MORSE DUAL FUEL POWER!

The basic and important economies of Fairbanks-Morse dual-fuel engines are amply evident in the first year's record of this 7200 hp. installation. Here are a few facts that should interest anyone who wants low-cost, unfailing power generation.

Plant requirements of 5600 hp. are met with three engines running at full load, one held in reserve . . . units in operation must run at an overload before the operator starts up another engine . . . frequently, electrical equipment is started across the line, pulling an estimated 500% overload . . . in one year there has not been a single shutdown due to engine failure . . . in six months the engines ran a combined total of 13,816 hours out of a possible 17,520 . . . engines can operate either as full diesels or on gas and can be switched instantly from one fuel to the other.

Look over these facts—then look into the matter of gaining the economies of dual-fuel operation in *your* plant. When you do, remember that there are more Fairbanks-Morse dual-fuel installations than any other—that Fairbanks-Morse has more dual-fuel experience—and that field conversion parts are available for many sizes and types of Fairbanks-Morse diesel engines. Write your nearest Fairbanks-Morse branch office or Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Illinois.

Look at this Six Months Performance Record!

1950	Kw-h Generated	Gas, MCF	Cu. ft. gas per kw-h	Fuel oil (Gals.)	Engine #1 2000 hp.	Engine #2 1600 hp.	Hours #3 2000 hp.	#4 1600 hp.	Lube Oil (Gals.)	Hp. hrs. per gal lube
JULY	2,305,100	25,505	11.06	15,489	682	597	606	530	984	4,450
AUG.	1,931,300	21,814	11.29	13,235	568	503	503	558	831	4,613
SEPT.	2,116,800	22,507	10.63	15,698	613	539	642	525	891	4,709
OCT.	2,174,900	23,769	10.92	15,300	607	576	577	587	894	4,741
NOV.	1,913,800	21,225	11.09	15,909	538	578	449	584	931	4,117
DEC.	2,333,800	25,157	10.73	18,596	666	517	656	615	891	5,000
Total	**12,775,700**	**139,977**		**94,227**	**3,674**	**3,310**	**3,433**	**3,399**	**5,422**	**4,601**

FAIRBANKS-MORSE,
a name worth remembering

DUAL-FUEL AND DIESEL ENGINES • ZC ENGINES • PUMPS
ELECTRIC MOTORS • LIGHT PLANTS • GENERATORS • SCALES

SIMPLICITY of AMERICAN METERS

IS IMPORTANT FOR A CITY

THAT STANDARDIZES

Simplicity of construction, ingenious parts-saving design and full interchangeability of all parts in American Meters help keep users' inventories low, labor costs low, total repair costs low. An investment in American Meters pays dividends.

Individual parts are interchangeable not just for models of one or two years but over a period of 30 years. This is a basic company policy.

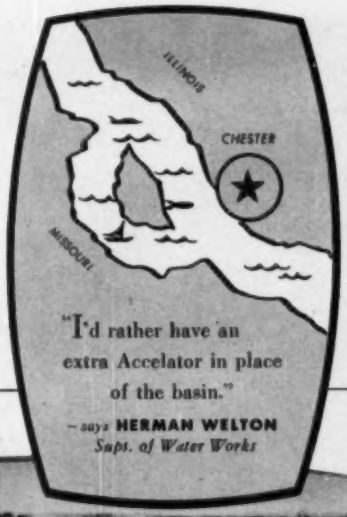
Write for full details.

BUFFALO METER CO.

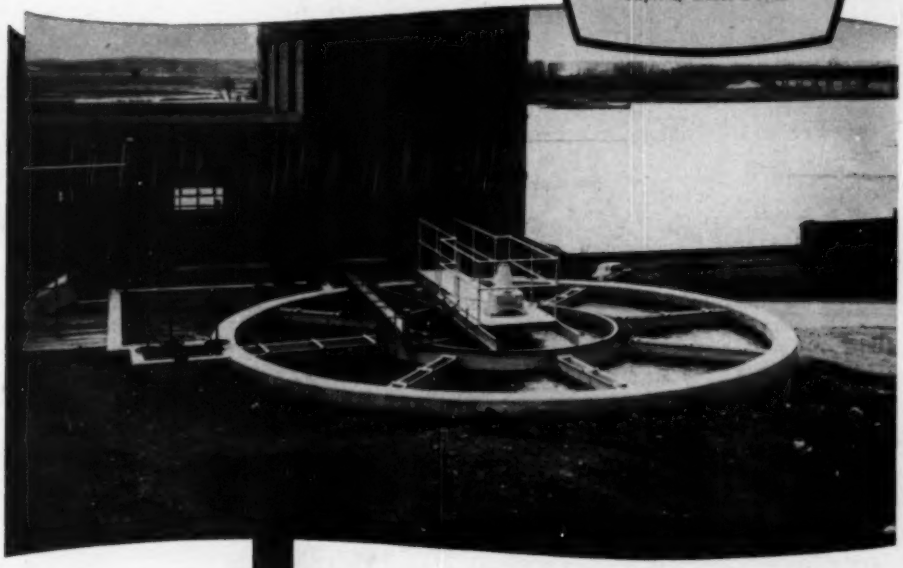
2909 MAIN STREET, BUFFALO 14, NEW YORK

with the **Accelator®**

Chester, Illinois, no longer needs 2-hour presedimentation basin...



"I'd rather have an extra Accelator in place of the basin."
– says **HERMAN WELTON**
Supt. of Water Works



CLEARER WATER FASTER
with exclusive slurry recirculation
SAVE UP TO 80%
in space (with lower construction costs)
SIMPLER OPERATION
– mixing, coagulation, clarification and sludge removal all in one unit
FASTER CHEMICAL REACTION
HIGH RATINGS

This Infilco plant at Chester, Illinois, handles 2,000,000 g.p.d. of Mississippi River water ranging from 400 to 4000 p.p.m. turbidity. The Accelator produces an effluent of 2 to 12 p.p.m. and is so efficient that a 2-hour presedimentation basin is no longer needed and has been taken out of service.

INFILCO
• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1914 •

INFILCO INCORPORATED | *Tucson, Arizona*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment

POSTMARKS OF PROGRESS!

Is your city joining the growing trend towards making whole communities garbage-free?

Clear across the country, more and more progressive-minded civic leaders are adopting the new, more hygienic method of garbage disposal—the General Electric way.

By municipally sponsoring the revolutionary G-E Disposall®—which eliminates garbage *electrically* by converting food waste into sewage—they are taking the lead in giving *entire communities* the benefits of this tremendous modern advance in sanitation.

In Jasper, Indiana, for instance, installation of G-E Disposalls is already complete in two-thirds of all homes. The city's garbage collection service has been suspended.

In Herrin, Illinois and Mount Dora, Florida, whole groups of fortunate housewives—thanks to municipal action—have joined the ranks of more than 250,000 G-E Disposall users. They now wash away *processed* food wastes—simply by turning the kitchen faucet.

If *you* are in any way concerned with civic planning or sewage treatment, now is the time to consider how the G-E Disposall, perfected by 15 years of pioneering and improvement, can bring new convenience and better health to your community.

Let us answer your questions and send you printed information—or even a personal consultant to discuss your special problems. Write General Electric Company, Dept. W7, Bridgeport 2, Connecticut.

G-E DISPOSALL

CONVERTS FOOD WASTE TO SEWAGE—
ELIMINATES "GARBAGE"

Trim and specifications subject to change without notice.

You can put your confidence in—

GENERAL ELECTRIC

for primary and secondary settling tanks

Jeffrey Collectors—designed for rectangular shaped settling tanks — simplest and most efficient type of sedimentation device.

Large Carrying Capacity — permits intermittent operation.

Stable Conditions of Flow—resulting from proper baffling of influent and correct location of effluent troughs.

Considerable Power Saving—one-half revolution of conveyor once or twice daily sufficient to remove all settled sludge — thicker sludge and clearer effluent.

Positive Movement of Scum — to effluent end of tank for removal by Scum Removers.

These Collectors — for small, medium or large tanks—have been installed in many plants—all same general, well-proved design. Besides we make Bar Screens, Grit Washers and Collectors, Scum Removers, Chemical Feeders, Grinders, Sludge Elevators, Flocculation Equipment, etc.

A competent Sanitary Engineer, well versed in the treatment of water and sewage by mechanical means, will be glad to make recommendations.

JEFFREY

ESTABLISHED 1877

JM

SALES OFFICES IN PRINCIPAL CITIES

THE JEFFREY MANUFACTURING COMPANY 996 NORTH FOURTH STREET, COLUMBUS, OHIO

KID, WHEN YOU'RE A GRAN'FATHER THESE DRESSERS'LL STILL BE TIGHT!

More than 60 years of use and half a million miles of pipe have proved that pipe lines stay tight when joined with Dresser Couplings.

On new mains or main extensions, Dressers assure a line that's *flexible-tight*. Specially compounded rubber gaskets protect lines for life against punishing stresses of vibration, expansion, contraction. Up to 4° deflection per joint—a big advantage when you're laying out a curve. Leakproof joints are assured because Dressers provide controlled gasket pressure through controlled bolt tightness around the joint.

Dresser Couplings are installed rapidly, and the longer lengths possible with steel pipe reduce the number of joints needed. No heat to damage linings—no need for workmen to go inside the pipe. Even inexperienced help can get lines in service sooner. You save costly man-hours, get life-time dependability.

DRESSER

"FLEXIBLE-TIGHT"

COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide Street, W., Toronto, Ontario

Dresser Couplings are available in sizes ¾" through 72" and larger. Ask your Dresser Sales Engineer for details, or write to our main office.

EVANSTON, ILL.

Evanston Water Works

(ENLARGEMENT COMPLETED IN 1950)

ALVORD, BURDICK & HOWSON
Engineers
CHICAGO, ILLINOIS

HORACE R. FRYE
Supt. of Water Dept.
EVANSTON, ILLINOIS

B-I-F Industries Equipment furnished for the enlargement of the Evanston Water Works:

OMEGA
Loss-In-Weight Gravimetric Feeders for Alum, Ferric Sulphate, Hydrated Lime, Carbon and Sodium Fluoride.

BUILDERS-PROVIDENCE
Venturi Meters for Raw Water, Wash Water, Surface Wash and High Service.

Chronoflo Telemeters for Storage Reservoir, Wash Tank, Elevated Tanks, Settling Basin and Clear Well.

Summation Meters for Raw Water and Wash Water.

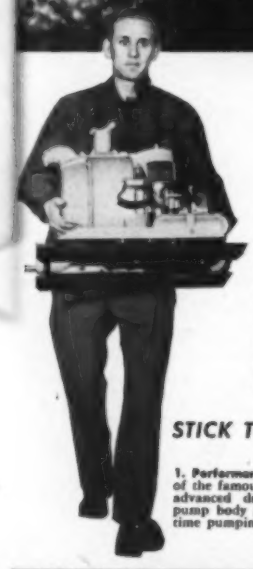
Evanston faced a serious municipal problem following World War II when rapid increases in population made it apparent that the Water Works would soon be inadequate for the needs of the city. An enlargement and improvement program which was initiated in 1945 and completed in 1950 has now doubled the original plant, thus providing the city with a high quality water supply of 48 MGD. Due to space limitations, the new additions had to be superimposed on the existing Water Works without interrupting its operation, a difficult feat of engineering and construction.

To feed the chemicals required by the treatment process (lime, alum, activated carbon, and sodium fluoride) Omega Chemical Feeders were approved by the Engineers, Alvord, Burdick & Howson, and installed by E. W. Bacharach, Inc. of Kansas City, Mo. Because of these new feeders and the recently completed additions to the Water Works, residents of Evanston will continue to enjoy the advantages of a water supply that's ample in quantity and high in quality. For Bulletins describing Omega Water Works Equipment, address Omega Machine Company, (Division of Builders Iron Foundry), Providence 1, R. I.

B·I·F INDUSTRIES

OMEGA
THE LAST WORD IN FEEDERS

OMEGA



You'll never find a better pump than a

HOMELITE *Carryable* PUMP

Time is the best teacher. And the last quarter century has thoroughly proved that for easy handling, quick starting, fast priming, fast pumping and downright dependability, a Homelite Carryable Pump really tops them all. Light enough for one man to carry, a Homelite is easily put into operation any place, quickly. It is self-priming — faster than any other pump. Non-clogging. Has a 28 ft. suction lift. Automatically keeps seepage at strainer level and handles up to 15,000 gallons an hour. Send for your free copy of our latest pump bulletin.

STICK TO THE RULE OF THREE AND YOU'LL ALWAYS STICK TO A HOMELITE

1. Performance. The high, steady power of the famous Homelite engine, plus the advanced design and features of the pump body give you unsurpassed, long-time pumping performance.

2. Dependability. A Homelite Pump's dependability has been established by Homelite's quarter century experience in building more than 300,000 gasoline-engine-driven units.

3. Service. Forty-eight factory service branches located throughout the country are completely equipped and instantly ready to keep your Homelite Gasoline-Engine-Driven Pumps always in good working condition.

CARRYABLE
PUMPS • GENERATORS •
BLOWERS • CHAIN SAWS

PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE
CORPORATION
707 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Crane No. 465½
Iron Body Gate Valve

today piping repairs cost more!

You make fewer of them by using Dependable Quality

CRANE VALVES

...That's why more Crane Valves are used than any other make

No bonnet joint trouble with this valve

A typical example of low-maintenance Crane Quality—No. 465½ 125-Pound Iron Body Gates. Rarely does the bonnet joint need attention. Flange construction includes reinforcement to prevent distortion and utilizes more bolts, more closely spaced, than is usual in valves of this class. Crane precision-guided seating reduces seat and disc wear. Packing has long life because these valves have a deep stuffing box filled with high grade asbestos ring packing. A ball-type gland helps to equalize the packing load.

Better performance features like these make Crane the better buy in valves of every type. Ask your Crane Representative for a demonstration of Crane better valves.

CRANE CO.

General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

THIS IS THE 4th

For a Big Industrial Plant in Memphis

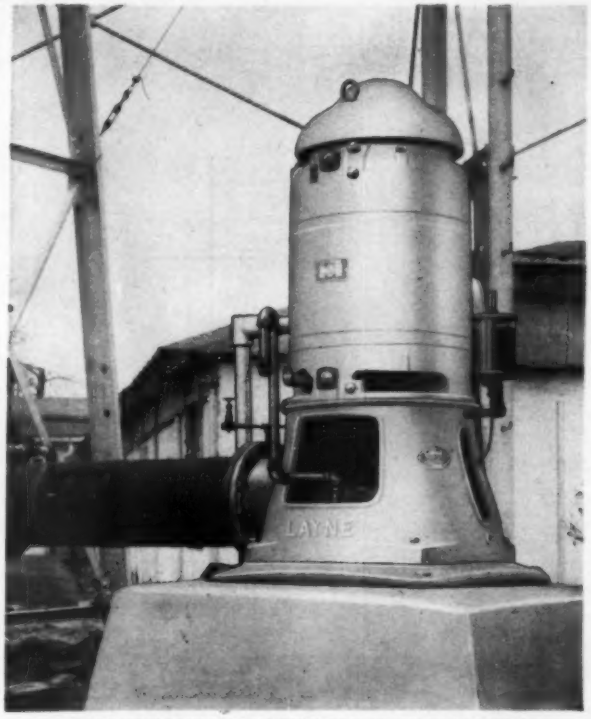
THE FIRST IN 1934 IS STILL PRODUCING ITS ORIGINAL CAPACITY

Seventeen years ago a big industrial plant of Memphis bought its first Layne well water supply system. World War II necessitated greater expansion which required two more Layne water supply units. Now the fourth has just been completed and is producing 1790 GPM whereas the contract guaranteed only 1500 GPM.

This is a typical case of where the first Layne installation proved to be so satisfactory that, as more water is needed, other Layne units are ordered as a matter of course. Certainly this industrial plant,—or any other big user of ground water, could make no finer investment.

Every Layne installation is a carefully engineered job from the original survey to the final testing. All have the same unmatched features of high efficiency, low upkeep cost and extra long life.

If you are considering the installation of a well water supply, a Layne engineer will be glad to make a study of your conditions. He will then recommend the type, size and overall capacity of a Layne unit—or units—that will best serve your water supply needs. There is no obligation.



4-TH LAYNE UNIT FOR AN INDUSTRIAL PLANT IN MEMPHIS

A New Catalog on
SHORT COUPLED SERVICE PUMPS

Layne's new catalog on Short Coupled Service Pumps will be sent on request. It illustrates many varied and practical applications of these high efficiency pumps such as: pressure boosting, river intake, drainage, cooling, spray pond, fire, etc. Requests should be made on company letterheads.

Built Complete By Layne

The installation shown above—and all Layne well water supply units—are planned and installed complete by Layne's own field crews. All installations are under the constant supervision of Layne engineers which assures the owner of getting a tip top job from start to finish. Once installed, all Layne systems have the continued interest of Layne from whom any adjustment or repair can be obtained at any time.

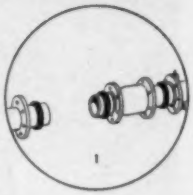
LAYNE & BOWLER, INC., GENERAL OFFICES, MEMPHIS 8, TENN.

Layne
WATER SUPPLY
WELLS & PUMPS

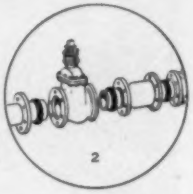
If you have to install a valve in a hurry--with an eye toward economy....

...specify EDDY Cutting-in Valves and Sleeves

After excavation and removal of section of pipe, glands and gaskets are placed on pipe and sleeve. The sleeve is then pushed into position.



Valve is placed between pipe-end and sleeve, and pushed home against pipe. Sleeve is seated into bell of valve.



Glands, gaskets, bolts and nuts are then assembled at the 3 joints and tightened, using a ratchet wrench only.

Since 1849 EDDY For Long Service

EDDY
VALVE COMPANY
A Subsidiary of James B. Clow & Sons
WATERFORD, NEW YORK

Starting with step "1" above, two men with a ratchet wrench can install an Eddy Mechanical Joint Cutting-in Valve and Sleeve on an existing pipeline in less than 25 minutes. Every joint is bottle-tight under pressure, without caulking or lead-melting. Thus, the work can be done in any kind of weather, or in a flooded trench. Valves meet AWWA specifications; are available in 3 to 12" sizes for sand-cast and centrifugally-cast iron water pipe. Stock up now, for speedy installations.

AMERICAN DOUBLE-X Mechanical Joint Pipe

For quick laying, superior quality and tight joints, specify American Double-X Mechanical Joint Pipe. Long service with minimum maintenance, coupled with simplicity in installation, make this pipe a favorite for systems conveying water, sewage, gas, oil and other liquids under high, medium, or low pressures.

American Double-X pipe is regular Mono-Cast centrifugal pipe equipped with the standardized mechanical joint for cast iron pipe. The American Double-X joint is the original standardized mechanical joint which was put on the market in 1929.

A complete line of fittings for use with American Double-X pipe is available, including transition pieces for inter-connecting with other types of joints and pipe.

Refer your next piping problem to ACIPCO and utilize both our extensive manufacturing facilities and our nearly half a century of experience in furnishing pipe and fittings.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

Dallas
Chicago
Los Angeles
Houston
Minneapolis
San Francisco
El Paso
New York City
Seattle
Pittsburgh
Cleveland
Kansas City

"Egads . . . This water tastes like a PHENOL cocktail"

Besides the four fundamental tastes—"salt," "sweet," "sour" and "bitter"—industrial wastes in water supplies have added a fifth taste . . . "chemical." Phenol (carbolic acid) is typical of these troublesome industrial tastes and odors resulting from river or lake pollution.

Many water works operators now use Aqua Nuchar Activated Carbon to remove phenolic tastes and odors from their water. Aqua Nuchar actually removes phenol and its derivatives from the water by physical adsorption . . . thus they cannot reappear or be disguised.

INSURES PALATABLE NUCHAR DRINKING WATER

industrial CHEMICAL SALES

division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.
230 PARK AVENUE
NEW YORK 17, N. Y.

LINCOLN-LIBERTY BUILDING
BROAD AND CHESTNUT STREETS
PHILADELPHIA 7, PA.

2778 EAST 152ND STREET
AT SHAKER SQUARE
CLEVELAND 20, OHIO

PURE OIL BLDG.
35 E. WACKER DRIVE
CHICAGO 1, ILL.

OTHER PRODUCTS: Snow Top Precipitated Calcium Carbonate—Nuchar Activated Carbon—Ligro Crude Tall Oil —Talloco Tall Oil Pitch—Indusoil Distilled Tall Oil—Tallex Abietic Acid—Polycel Cellulose Fibers—Indulin (Lignin)

***THE FIRST REAL PIPE THAT IS PLASTIC!**

CARLON . . . the outstanding pipe development of modern science . . . is tomorrow's pipe today. This new medium for fluid and gas transmission combines the inherent advantages of plastic with the desirable characteristics of metallic pipe to create unprecedented longevity, versatility and ease of installation. Whether used for municipal water systems, sewage disposal, land drainage or other medium-pressure low temperature applications, CARLON has a trouble-free service life many times longer than ordinary pipe. It is guaranteed against rot, rust and electrolytic corrosion and will not accumulate scale or sediment. CARLON is inert to the chemical action of corrosive soils and waters.

CARLON plastic pipe is shipped in threaded and coupled random 21-foot sections. A complete line of CARLON plastic fittings incorporating standard I.P.T. is available to permit complete corrosionproof plastic installations as well as connection to fixtures and previously installed metallic lines.

At present, raw material shortages are limiting the production of certain types of CARLON pipe. Every effort is being made to overcome this problem and to meet the need for CARLON . . . the first real pipe that is plastic.

CARLON CP 218-CP

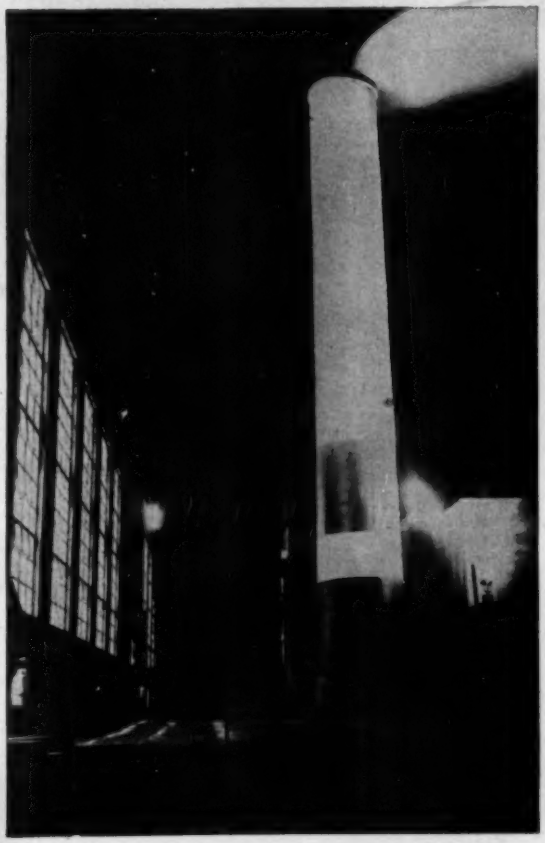
CARLON PRODUCTS CORPORATION

10132 Meech Avenue • Cleveland 5, Ohio

In Canada: Micro Plastics, Ltd., Acton, Ontario

1,650,000 pounds of filter cake per day

handled at new Los Angeles Plant



The new Hyperion Plant in Los Angeles is one of the largest and most modern sewage treatment plants in the United States. It covers more than 75 acres and has facilities for disposing of liquid wastes from an equivalent population of three million.

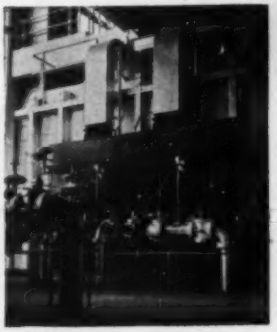
To dry the activated digested sludge there are installed at this plant four C-E Raymond Flash Drying Units each designed to dry or incinerate over 200 tons of filter cake per day, the equivalent of an evaporation rate of 22,500 pounds per hour. These are the *largest units* in use on sewage sludge *anywhere*. The plant is designed so that the sludge can be dried and marketed as fertilizer, or incinerated to a sterile ash.

This new plant is typical of C-E Raymond System installations, now in service in virtually all parts of the country, meeting the varying requirements of both large and small communities. They are flexible in layout, highly efficient and thoroughly reliable; they provide for maximum utilization of waste heat.

The services of C-E specialists are available to assist you in finding the best solution to *your* sludge disposal problem. Get in touch with the office nearest to you for prompt attention.

Industrial sludges a problem?

C-E Raymond Flash Drying and Incineration Systems have been the answer for others. Write for information.



Representative list of C-E Raymond installations since 1945

BALTIMORE, Md.
BETHLEHEM, Pa.
CHICAGO, Ill. (W. Southwest)
FOND DU LAC, Wis.
HOUSTON, Texas
LOS ANGELES, Calif.
SAN DIEGO, Calif. (Extension)
SAN FRANCISCO, Calif.
SCHENECTADY, N. Y.
SHEBOYGAN, Wis.
WATERBURY, Conn.
COLNE VALLEY, England
RECIFE, Brazil
WASHINGTON, D. C.

COMBUSTION ENGINEERING—SUPERHEATER, INC.
FLASH DRYER DIVISION

1315 North Branch Street, Chicago 22, Illinois

Western Office: 560 W. Sixth, Los Angeles 14, Calif. • Eastern Office: 200 Madison Ave., N. Y. 16, N. Y.

B-401

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

Short-cut to..... Short lengths..

CLOW Cast Iron Pipe

★ *View of Sewage Treatment Plant, Hammond, Ind. . . . one of the many plants where Clow Cast Iron Pipe in short lengths was furnished to exact specifications.*

The sanitary engineer, faced with difficult piping problems, knows the importance of short lengths of pipe. The Clow shops, completely equipped with the latest machinery run by experienced mechanics, will fabricate pipe to exact specifications. Pipe can be furnished flange and flange, flange and bell, flange and plain end or both ends plain—in all sizes 3 through 24 inches and in all laying lengths up to 18 feet.

Clow Threaded Cast Iron Pipe

Clow Cast Iron Pipe is also available in Iron Pipe Size O. D., with flanged, plain, or threaded ends. May be cut, threaded and fitted on the job or we can furnish to your exact specifications. In 3″ size—16 ft. random lengths; 4″, 5″, 6″, 8″ and 10″ sizes—18 ft. lengths.

The Clow Catalog PIPE ECONOMY fully illustrates our line of cast iron pipe, fittings, valves and specials for sewage treatment plants. Send for it *today!*

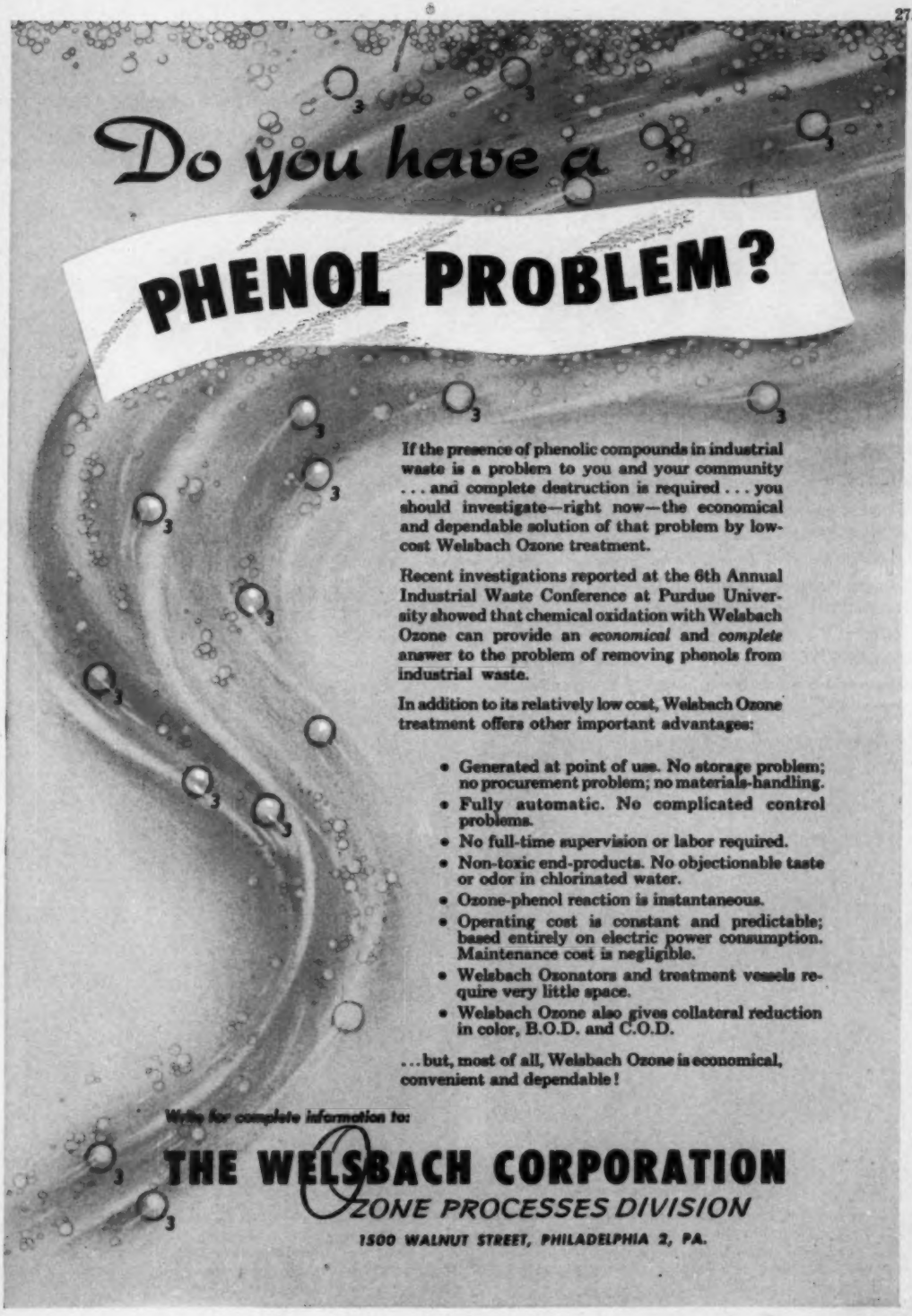
Strickler Ratchet Pipe Cutter

Quickly, easily cuts steel, wrought or cast iron pipe in the trench or shop. Available in five sizes for cutting pipe 2½ to 24 inches.

JAMES B. CLOW & SONS

201-299 North Talman Avenue • Chicago 80, Illinois

and their National Cast Iron Pipe Division, Birmingham, Alabama; subsidiaries Eddy Valve Co., Waterford, New York; Iowa Valve Co. Oskaloosa Iowa



Do you have a PHENOL PROBLEM?

If the presence of phenolic compounds in industrial waste is a problem to you and your community . . . and complete destruction is required . . . you should investigate—right now—the economical and dependable solution of that problem by low-cost Welsbach Ozone treatment.

Recent investigations reported at the 6th Annual Industrial Waste Conference at Purdue University showed that chemical oxidation with Welsbach Ozone can provide an *economical* and *complete* answer to the problem of removing phenols from industrial waste.

In addition to its relatively low cost, Welsbach Ozone treatment offers other important advantages:

- Generated at point of use. No storage problem; no procurement problem; no materials-handling.
- Fully automatic. No complicated control problems.
- No full-time supervision or labor required.
- Non-toxic end-products. No objectionable taste or odor in chlorinated water.
- Ozone-phenol reaction is instantaneous.
- Operating cost is constant and predictable; based entirely on electric power consumption. Maintenance cost is negligible.
- Welsbach Ozonators and treatment vessels require very little space.
- Welsbach Ozone also gives collateral reduction in color, B.O.D. and C.O.D.

. . . but, most of all, Welsbach Ozone is economical, convenient and dependable!

Write for complete information to:

THE WELSBACH CORPORATION

OZONE PROCESSES DIVISION

1500 WALNUT STREET, PHILADELPHIA 2, PA.

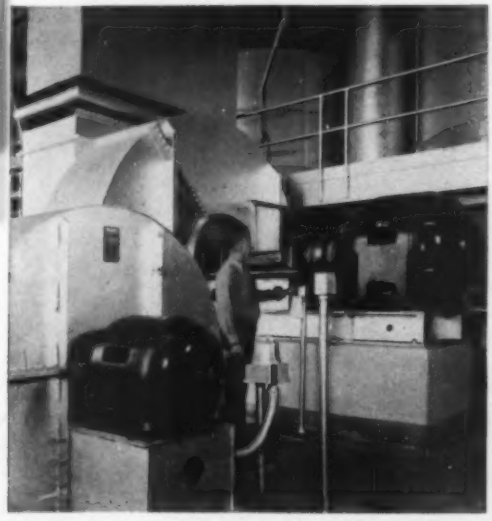
HYPERION BRINGS CLEAN WATERS TO LOS ANGELES

G-E equipment plays vital role in one of world's largest sewage treatment plants, due for 1951 completion

Hyperion Sewage Treatment Plant at El Segundo, California will serve the entire Los Angeles area. The $42,000,000 installation will be almost completely self-sufficient; it will generate all the power and produce nearly all the fuel required for its operation.

General Electric application engineers, working with contractors and architects, have fitted G-E motors and control components to many of the plant's intricate operations. Pictured on these two pages are some of the applications of General Electric equipment that will help reduce Los Angeles' raw sewage discharge into the ocean to a standby disposal.

General Electric helps you in (1) winning public support with the complete G-E packaged program "Modern Sewage Treatment" including the full-color sound movie *Clean Waters*, and (2) by assisting in the formulation of electrical plans. Help make your pollution-control program a success by contacting your G-E representative early in the planning stage. *General Electric Company, Schenectady 5, N. Y.*

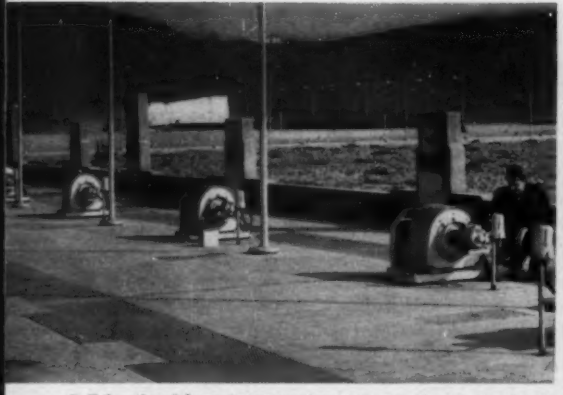


A plant foreman starts one of the G-E 250-hp motors that drives a vapor fan. In the foreground is 30-hp General Electric motor driving combustion air fan. All motors in the plant were selected by G-E engineers to fit the particular application.

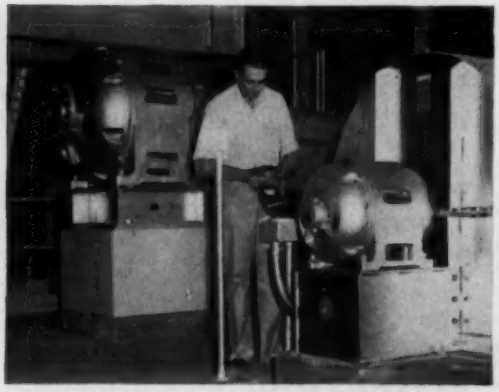
The intricate sludge conveyor system is powered by G-E Tri-Clad* gear-motors, shown here ready to go into operation. Their attractive appearance is backed by cast-iron construction for corrosion resistance.

** Registered Trade-mark of General Electric Co.*

Hyperion Sewage Treatment Plant covers 76 acres of reclaimed land near Santa Monica Bay, about 15 miles from downtown Los Angeles. The opening of the last unit in 1951 will climax ten years of planning and construction.

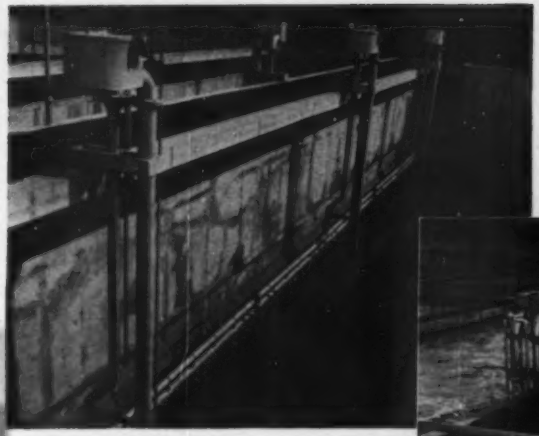


G-E fractional-horsepower motors drive the longitudinal collectors in the plant's primary settling tanks. These small, tough motors must give dependable day-in, day-out service regardless of any extremes of weather.



During installation of the equipment, the G-E hook-on voltammeter was used extensively. With it the operator can determine whether motors are drawing excess current plus numerous other jobs around the plant.

GENERAL ELECTRIC



DIFFUSAIR installation at Kirkwood, Mo. Impingement nozzles and bowls are on headers at lower left side of tank.

DIFFUSAIR at Kirkwood, Mo. in operation showing effective "spiral flow" agitation and aeration of tank liquor.

impingement aerator **DIFFUSAIR**

FOR

SEWAGE

WASTE AND

WATER TREATMENT

PRE-AERATION...

ACTIVATED SLUDGE

CARBONATION

The Impingement Aerator is a unit developed to accomplish more effectively and economically the diffusion of air as small bubbles to agitate and oxygenate aeration tank liquors.

The principle involved is the combining of a low velocity jet of tank liquor and large air bubbles within an open bowl-like impinger. The cavitation effect thus produced divides the air into smaller bubbles than those diffused from a No. 30 permeability porous tube. The amount and pressure of the impingement water is very low when compared with the progressive back pressuring of the blower that persists when other types of air diffusers are employed.

The impingement liquor is derived directly from the aeration tank mixed liquor, and is lifted with a simple air-lift unit from which 1/3 of the fine air is re-entrained and utilized for oxygenation.

The air is released along headers through 3/16 inch orifices in the impinger units and no air clogging is possible. No filtering of the compressed air supply is required since there are no fine diffusion pores to become clogged.

Write for Bulletin 17531

PROQUIP
PROCESS EQUIPMENT

WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA, ILLINOIS

These Siphon WATER STOPS STOP CORROSION too—with BYERS WROUGHT IRON

In constructing these concrete siphons, engineers of the Bureau of Reclamation, U. S. Department of Interior, took decisive steps to forestall excessive maintenance and insure leakproof joints by specifying genuine wrought iron water stops. The main illustration shows a finished section of the siphon laid at the Poudre Supply Canal, near Fort Collins, Colorado. This siphon has an inside diameter of 12'6". The insert photograph shows a section of the 3600-foot Olympus Siphon being poured into a form manufactured by the K-C Construction Supply Company of Denver. This siphon, near Estes Park, Colorado, has an inside diameter of 10'9" and links the Olympus Dam and the Olympus Tunnel. Both siphons are part of the Colorado Big-Thompson Project. Approximately 7500 feet of 3/16" x 8" Byers Wrought Iron plate was used for the water stops on the two siphons. Contractor for both jobs was Peter Kiewit Sons Company of Omaha.

The selection of genuine wrought iron for this service follows accepted design practice, and is endorsed by performance records that testify to the superior durability of this time-tried material.

The complete story of what genuine wrought iron is, how it is made, and why it lasts is condensed in our booklet, THE ABC's OF WROUGHT IRON. Ask for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY GENUINE WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of genuine wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

MUELLER WATER WORKS GOODS

HIGHEST QUALITY MATERIALS.
SOUND, PRACTICAL DESIGN.
PRECISION MANUFACTURING.

MANY EXCLUSIVE FEATURES.
CAREFUL INSPECTION.
THOROUGH TESTING.

Corporation and Curb Stops

Lead Flange Couplings, Solder Nipples, Brass Plugs

Service Boxes, Shutoff Rods, Repair Lids

Meter Yokes, Couplings, Stops and Covers

Fire Hydrants and Gate Valves

Sluice Gates and Operating Mechanisms

Regulators and Relief Valves

DEPENDABLE SINCE 1857 FULLY WARRANTED
OUR 93rd YEAR

MUELLER CO.

MAIN OFFICE AND FACTORY ..... DECATUR, ILLINOIS
OTHER FACTORIES: *Los Angeles, Cal.; Chattanooga, Tenn.; Sarnia, Ont. Canada*

Now--A Completely Hydraulic Dragshovel

The New BUCYRUS-ERIE HYDROHOE

- ★ Two separate digging actions
- ★ Eliminates up to 40 percent time lost moving up
- ★ No bails, sheave blocks or drag ropes to interfere with loading
- ★ Digs a level trench — reduces hand trimming, no scallops
- ★ Precision control — every work function fully hydraulic
- ★ Hydraulic ejector assures fast, clean dumping of dipper
- ★ Travels up to 50 mph. on open highway

Here is a completely new idea in dragshovels for trenching and related digging — the Bucyrus-Erie Hydrohoe. Every operating function is fully hydraulic — boom hoist, swing, dipper dig and dump, boom telescope, outrigger set and retract, and positive dirt ejector.

Control is so precise, Hydrohoe can operate efficiently and safely around buried pipe and conduit. Dipper can be moved a fraction of an inch if necessary.

Write today for full details. We'll be happy to arrange a demonstration.

BUCYRUS-ERIE HYDROCRANE DIVISION
SOUTH MILWAUKEE, WISCONSIN

★ Quickly convertible to crane in the field for handling buckets, forks, magnet and crane hooks.

136HB1C

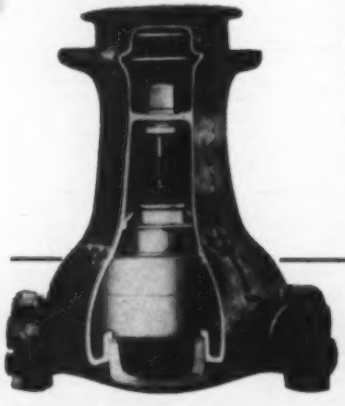
The Hydrohoe is the only dragshovel with two separate and distinct digging actions. The first is through a hydraulic ram located between boom and dipper handle. The second digging action comes from telescoping the boom. This exclusive telescope feature eliminates moving dragshovel back and forth when digging out boulders and excavating across pipe and cable . . . permits digging a level, scallop-free trench, greatly reducing hand trimming.

Available with interchangeable 18-in. and 12-in. wide self-discharging dippers, the Hydrohoe is adaptable to a wide variety of digging and trenching jobs.

DEPRECIATION

TRIDENT INTERCHANGEABILITY PROTECTS YOUR INVESTMENT *and your REVENUE*

NEW IN 1698 . . .
Better than new
TODAY . . .



Trident Interchangeability doesn't mean replacing old parts in old style meters. It means putting modern, improved parts in meters whose sound basic design has not changed in 50 years. Thus, these new, improved parts make old Trident Meters even better than when new. So Trident Meters do not depreciate in value nor in accuracy . . . they will not become obsolete.

NEPTUNE METER COMPANY • 50 West 50th Street • NEW YORK 20, N. Y.
Branch Offices in Atlanta, Boston, Chicago, Dallas, Denver, Los Angeles, Louisville, North Kansas City, Portland, Ore., San Francisco.
NEPTUNE METERS, LTD., Long Branch, Ont., Canada

229

BECAUSE OF TRIDENT INTERCHANGEABILITY
TRIDENT METERS WON'T BECOME
OBSOLETE

WATER & SEWAGE WORKS

VOL. 98, NO. 7 • A GILLETTE PUBLICATION • JULY 1951

FILTER REFILLING with "Anthrafilt" from stock-pile.

Water Treating Experiences

(The sixth of a series of articles.)*

Softening and Filtration of the Colorado at Austin, Texes

by A. H. ULLRICH, *Superintendent, Water and Sewage Treatment, Austin, Texas*

IN the previous article of this series* the characteristics of the Colorado River of Texas, Austin's source of water supply, were highlighted. It was shown how the power and flood control lakes of the Lower Colorado River Authority have served to stabilize both the flow in the river and the chemical and physical characteristics of the raw water coming into the Austin plant. In this same article a fairly complete description was given of the treatment plant facilities as they exist today at Austin.

*Earlier articles in this series appeared in W. & S.W. for Jan., 1950; March, 1950; May, 1950; Aug., 1950; Jan., 1951.

Prior to the building of the power and flood control dams upstream from the water works intake, there were wide variations in both the turbidity of the raw water and in the hardness and other mineral constituents. However, then, as now, the chief functions of the treatment plant were clarification, softening, and chlorination. Occasional taste and odor problems led to a few serious experiments in taste and odor control, but, on the whole, the taste and odor problems have been minor.

Lime Softening

The raw Colorado River water now has an average total hardness of about 169 ppm and we class it in the medium hardness range. Fortunately only about 27 ppm of this is non-carbonate hardness, while the remainder (about 142 ppm) is carbonate hardness. Fortunately also, the magnesium hardness is low, so that a very satisfactory water is obtained without treating for magnesium removal. While there have been a few brief periods when both soda ash and lime were used for softening, the general practice since 1924 has been to use lime only, and this without recarbonation for stabilization. There have also been a few brief periods when magnesium removal has been practiced, but apparently no material benefit was gained and some disadvantages were thought to be experienced in addition to higher costs.

From the above it may be seen that the nature of the raw water is such as to lend itself admirably to lime softening without excess lime treatment, and without the necessity of subsequent recarbonation for caustic alkalinity and pH reduction.

Control of Lime Application

Basically the lime softening treatment, as now used in Austin, consists in controlling the lime dosage so that

CLEANING porous plate filter bottom by recirculating muriatic acid.

the filtered water methyl orange alkalinity is as nearly twice the phenolphthalein alkalinity as it is possible to hold it. Because of operational difficulties in feeding and slaking exact amounts of lime, and because of slight fluctuations in raw water flows, it is difficult to maintain such exact alkalinity relationship. For this reason we prefer to treat to a point such that the methyl orange (total) alkalinity in the *filtered* water is 2 to 4 ppm above twice the phenophthalein alkalinity. The exact lime dosage is controlled by making alkalinity tests on the *treated* water at thirty minute intervals and by making similar tests on the settled and filtered water at two hour intervals. Experience has shown what the phenophthalein alkalinity (P) and methyl orange alkalinity (M) relationships are that is required in the mixed water in order to arrive at the desired results in the filtered water. As an example, the results of a typical series of control tests are as follows:

Sampling Point	Methyl Orange Alkalinity (M)	Phenolphthalein Alkalinity (P)	Total Hardness	pH
Raw Water	144 ppm	0 ppm	169 ppm	8.0
Mixed Water	78 ppm	32 ppm	106 ppm	—
Settled Water	62 ppm	30 ppm	87 ppm	—
Filtered Water	52 ppm	24 ppm	77 ppm	9.9

We have tried to use periodic pH tests for controlling the lime dosage but so far have not found them entirely satisfactory. However, we have recently installed a three point recording pH meter, with which we are making further tests in an effort to simplify and improve the testing for lime dosage control. It is also hoped that a continuous record of the pH at several points in the treatment process may prove to be valuable data in plant control and for future reference.

Filter Maintenance vs. Lime and Carbonation Costs

From the above it will be realized that the settled water reaching the filters is still unstable (incrusting in nature), and that we remove approximately 10 ppm of carbonate hardness on and in the filters. This reduction in hardness is, of course, obtained because of an equivalent amount of calcium carbonate incrustation on the filter media, and this results in a shortened life of the media. Austin has frequently considered the advisability of recarbonation just ahead of the filters, but there are two very good reasons why we feel justified in continuing the use of the filters for stabilization. First, by treating as we do, our filtered water is about as well stabilized and as non-corrosive as we believe it is practicable for us to try to make it. Second, the lower cost per part of hardness removed, which the use of filter media for stabilization effects, more than offsets the increased filter maintenance cost.

In our case the filtered water is almost completely stabilized. It is just unstable enough to form a thin egg-shell like protective film of calcium carbonate throughout the inside of our distribution system. Perhaps, due to our high per capita water usage and the quick movement of the water through the mains, the thickness of this film is not excessive in the piping near the plant, yet is adequate in the piping at the far ends of the distribution system. Within the last year we have removed sections of our twenty-four inch cast iron wash water line in order to tie in a new wash water pump. While this line had been in service, without being cleaned, since 1924, the calcium carbonate film was dense and only about one thirty-second of an inch thick and had been deposited in such manner as to give ideal protection against corrosion (see illustrations). The only uneven places on the inside of the pipe, and these were few and small in size, were spots where tuberculation had started *before* the calcium carbonate incrustation could give adequate protection. Also within the last year we have replaced a 4,000 gpm. high service pump which was installed in 1936. As in the case of the old wash water line, the piping to and from the pump was found to be in essentially perfect condition. In this case the incrustation and coating was also approximately one thirty-second of an inch thick, part of it being pipe scale. As noted from the accompanying photographs, taken of the inside of some of the pipe fittings, the surface was ideally smooth. In other cases there were a few rough spots where tuberculation had started before the calcium carbonate coating could be built up to give adequate protection. There are some locations in our distribution system where the incrustation is rough and wavy and, likely increases the friction loss materially at high water velocities. However, it now appears that this roughness may be due, not so much to an uneven deposition of the calcium carbonate as to the beginning of rusting or tuberculation before the incrustation was thick enough to give adequate protection.

The writer's experience with the very soft Fort Smith, Arkansas, water showed that if the pH was maintained at 8.8 or higher the water would remove the zinc coating from galvanized pipe. Since at Austin, we maintain a pH ranging from 9.8 to 10.0 in the filtered water there would, no doubt, also be danger of zinc removal were it not for the fact that the water contains sufficient calcium carbonate and is just unstable enough to deposit a protective film over the galvanizing. Our observations to date indicate that the water does actually exhibit a tendency to soften zinc galvanizing on new pipe but that the action stops

EXPERIMENTAL filter-bottom of perforated galvanized plates drilled with ⅛" holes on 1¼" centers.

when a calcium carbonate film of sufficient thickness has been deposited. It would seem, then, that if recarbonation is practiced, it should either not be to complete stabilization or it should be to a pH value below the softening point of zinc.

Returning to the second reason as to why we use our filters for stabilization, it is because by this method we remove approximately 10 ppm more hardness with a given lime dosage than would be possible if practicing recarbonation or calgon treatment of the settled water. We now use, on an average, approximately 735 pounds of quicklime per million gallons of water in order to reduce the hardness from 169 ppm in the raw water to 77 ppm in the filtered water. That is, approximately 735 pounds of quick lime is used for an overall reduction of 92 ppm of hardness. If we reduced the hardness only to 87 ppm (an 82 ppm reduction) with the same amount of lime, then we would obtain only about one-eighth the softening efficiency which we now obtain. Since our delivered lime cost for 1950 was approximately $32,000 we feel that the use of the filters for hardness reduction will be worth approximately $4,000 in chemical cost alone. We are, of course, also spared the added cost of recarbonation or other methods of stabilization.

PROTECTIVE CALCIUM-CARBONATE FILM on pipe interior. Note smoothness and thinness of egg-shell film standing by pocketknife on bottom of pipe. Small black patch is where film was chipped out. This pipe in service 16 years.

"Anthrafilt" Experience During 8 Years

Obviously, our method of using the filters for stabilization and hardness reduction does increase our filter maintenance cost. The author's three years of experience in Austin is still too short for him to evaluate this accurately. However, the "Anthrafilt" in some of our seventeen filter units has now been in service for eight years. While these units are still producing excellent water the incrustation of the media is admittedly on the heavy side, up to 75% of the total weight (not volume) being calcium carbonate. Three years ago we started a planned schedule to replace the "Anthrafilt" in the three oldest filter units each year so that the media in each unit would be replaced every five to six years. The "Anthrafilt" which was placed in service three years ago is still in excellent condition and it now appears that it will give satisfactory service for at least the planned period. We feel that if the life of the filter media is five years or more we can easily justify the use of the filters for stabilization on a straight cost basis.

Formerly a great deal of trouble was experienced from cementation of the filter media so that large lumps of cemented material would form within the filter beds. During that time very long filter runs were the rule, especially when the applied water was exceptionally low in turbidity. We felt that the long filter runs probably permitted the incrustation between the "Anthrafilt" particles to form to such an extent that the force and turbulence of a normal backwash was not sufficient to again separate the particles. About three years ago we reduced the maximum filter runs to 75 hours, and apparently this has solved the cementation problem. It has been our feeling for some time that since filters are used for removing objectionable matter which has not previously settled out they are entitled to a thorough backwash after a given maximum run, even if the loss of head would permit much longer runs. In our case the planned shorter filter runs have apparently also resulted in shorter washing periods so that we are using very little more wash water than formerly and maintaining cleaner filter-beds.

Experience with Porous Filter Bottoms

In a previous article of this series it was noted that Austin installed two new filter units with porous plate bottoms early in 1947 and then installed three additional porous plate units during late 1948 and early 1949. When these bottoms were installed it was anticipated that they would become clogged by our unstable water, but it was felt that since the clogging would be caused by a calcium carbonate deposit it would be a relatively simple and inexpensive process to clean the plates in place with muriatic acid. In this, our experience has not been so satisfactory. Before the peak summer load in 1948 we gave a hurried acid treatment to the two units which were installed in 1947 and we believed that considerable cleaning had been accomplished. Early in 1950 we decided to give both these units a thorough treatment so that they would be in top condition for the summer peak load. First, we removed the "Anthrafilt" and then "flowed" muriatic acid on to the top of the plates. There was a great deal of foaming for a while and the top of the plates soon looked clean but we noticed that the acid penetrated the plates only very slowly. Repeated additions of acid did not result in a corresponding degree of foaming nor did the penetration improve greatly. We then re-

EXPERIMENTAL FILTER BOTTOM of perforated galvanized plates ready for gravel and sand bed.

moved some of the plates for inspection and found that the acid had cleaned them to a depth of only about one-fourth of an inch. Later we added enough dilute acid to completely submerge the plates. This was then circulated by pumping it from the bottom of one section on to the top of the other section and vice versa but this too gave very little improvement. A similar treatment with a strong chlorine solution was unsuccessful, as was a treatment with a very strong "Calgon" solution. It became our opinion that the initial acid treatment had a tendency to open passage ways, especially at the joints, and that the succeeding treatments followed these paths of least resistance without removing a great deal of the calcium carbonate deposited elsewhere in the plates. This was at least partially confirmed by inspection of a number of plates which were removed after receiving all of the various treatments. Each of the plates examined had been cleaned to a depth of one-fourth inch or more on all six sides but still retained a great deal of incrustation in the middle of the plate.

While we concluded that our attempts at cleaning the porus plates in place were definitely unsatisfactory, we did feel that the job was good enough to make the plates serviceable for one or possibly two additional seasons. We found, however, that we could not replace the still partially clogged old ones, which had been removed and broken for inspection, with new ones because the new ones would pass a great deal more wash water, giving rise to very uneven washing. Since we had given the two 1947 filter units essentially identical treatments we "borrowed" enough "treated" plates from one unit to replace all broken plates in the second unit. Subsequent head loss tests showed that the plates had been cleaned sufficiently to give additional service. Of the two 1947 filters we now had one with a complete filter bottom with partially clean plates and one unit with neither enough new nor partially choked plates for a complete bottom. We removed all the plates from this latter unit and installed an experimental perforated galvanized sheet iron bottom in their place. This permitted us to have all of our filter units back in service well before the summer peak load.

It is possible that, in our case, the clogged porous plates could be completely cleaned by removing them from the filter box and soaking them in an acid bath, or forcing a mixture of air and acid solution through them as was done at Cleveland, Ohio, as a method of rehabilitating porous plates at the sewage treatment plant. We have not tried either of these methods because we believe the cost involved in removing, cleaning, and replacing the plates would be prohibitive. Actually, we are now of the opinion that porous plate filter bottoms will be too troublesome for us to continue their use with our unstable and incrusting applied water. It is likely that if we stabilized our applied water either by recarbonation or with "Calgon" they would give long and satisfactory service. This opinion is based on the author's very satisfactory earlier use of porous plates in treating a soft and non-incrusting water.

Experimental Bottom of Perforated Plates

While the writer does not wish, in any way, to recommend the installation of perforated galvanized steel plate filter bottoms it may be of interest to give a brief description of the

unit which we installed early in 1950, and our experience with this bottom to date. The bottom consists of No. 12 gauge galvanized sheet steel plates, perforated with one-eighth inch holes spaced one and one-quarter inches center to center. To speed up the perforating operation as many as ten plates, each three feet wide by ten feet long, were stacked on and clamped to the top of a heavy wooden table. The top plate was then marked and center punched after which all ten plates were drilled at the same time. After all the plates were drilled they were trimmed by acetylene torch to fit into the filter box. The edges of the plates were then bolted to one quarter by two inch steel runners which had been previously placed in the correct position on top of the concrete piers which originally supported the porous plates. The same bolts in the concrete piers which had originally held the porous plates in place were then used for securing the galvanized steel plate assembly. Before placing any media on top of the plates we made a number of full rate backwashing tests in order to determine if there would be any excessive jet action through the perforations. In no case did the first water coming through the plate jet more than six inches and this jet action diminished rapidly as water accumulated on the plate. After only a few inches of water had accumulated on the top of the plate no more jet action was observed and after the water depth was six inches the rise was completely uniform throughout the filter area. After these trial backwashing tests the following filter media was placed in layers on top of the perforated plate:

3 inch layer ⅜" x ⅝" gravel
3 inch layer 3/16" x ⅜" gravel
3 inch layer No. 12 x 3/16" gravel
27 inch layer No. 1 "Anthrafilt"

To date the perforated galvanized steel plate underdrain filter has given excellent results. From the standpoint of uniformity of backwashing and filtering it performs as well or better than any of the other filter bottoms which we have tried. Its use is admittedly an experiment which we undertook because we were in a hurry to get a filter back in service. Obviously we would not recommend the use of galvanized steel underdrains for permanent installation when used with corrosive waters. With our incrusting water there is a possibility that we may obtain years of service from this material. However, if this original unit continues to perform well we may regret not having used the more expensive and more difficult to fabricate stainless steel so that there would be no question regarding the permanence of the installation.

Coagulation

As previously noted, the turbidity of the raw Colorado River water is normally less than 10 ppm. The choice of a suitable coagulant depends, therefore, on its efficiency in coagulating the calcium carbonate precipitate from the softening reaction, as well as on turbidity removal. Both ferrous and ferric sulphate give excellent results when added ahead of the lime. With normal turbidities the required ferrous sulphate (copperas) dosage averages between 30 and 40 pounds per million gallons. Recent tests indicate that the same type water requires only 20 to 30 pounds of ferric sulphate for equally good results. In the past, copperas has been used almost exclusively. In the future the relative cost, ease of handling, ease of feeding and availability will probably determine

FULL JET EFFECT from perforated plate filter bottom with wash water on full.

whether ferric sulphate will replace the less expensive ferrous sulphate.

Disinfection and Taste and Odor Control

The use of chloramines for disinfection (sterilization) as well as taste and odor control has been successfully practiced at Austin for a number of years. Both the chlorine and ammonia are applied to the raw water so that adequate mixing and contact time are insured in the mixing chamber, settling basin, and filters. It is felt that the maintenance of the proper residual throughout the plant serves as a definite factor of safety in case of chlorine machine failure and is also an aid in keeping settling basins and filters in good condition. We apply the ammonia slightly ahead of the chlorine so that the chlorine has very little chance to act on organic matter before it forms chloramine with the ammonia. The dosage added varies with the chloramine demand of the water; and this in turn varies with the organic matter in the water, the water temperature and the amount of sunlight to which the treated water is exposed in the settling basins. Experience has shown that in our case the best results are usually obtained when a one to six ratio of ammonia to chlorine is used. However, this ratio is sometimes varied with variations in the raw water quality. Normally, we maintain a residual of approximately 0.6 ppm of chloramine chlorine in the filtered water and the dosage applied to the raw water is varied in order to give this amount of residual. We would prefer to carry a lower residual but the relatively high pH to which we treat the water, plus the short contact time which we now have through the plant at peak loads, usually requires a residual in excess of 0.5 ppm in order to assure a complete B. Coli kill. With a chloramine residual of 0.5 to 0.7 ppm in the water leaving the plant the residual in the far ends of the distribution system, except in dead ends, is usually from 0.3 to 0.4 ppm or higher. As noted in a previous article, the author's experience in treating very soft water indicates that high chlorine and high chloramine residuals aggravate the corrosive tendency of the water. Fortunately the calcium carbonate film which our slightly incrusting water deposits in our mains apparently gives ample protection against any increase in the corrosive tendency which our water might otherwise exhibit.

While there is some doubt in our minds that chloramines remove or greatly affect tastes and odors already present in the water it is our belief that they are less likely to aggravate such tastes than is the case with chlorine alone. Except for a very few periods of short duration we have been fortunate enough to produce a very satisfactory water through the use of chloramines alone. However, break-point chlorination has been tried on several occasions, both for taste and odor control and for speeding up the bacterial kill. The last time this was tried under the writer's direction the taste of the water deteriorated instead of improving and we returned to the use of chloramines. It is not clear why break-point chlorination has been unsuccessful with our water but there is some thought that the high pH required for the softening reaction interferes in some way. In this connection it is interesting to note that when break-point chlorination has been unsuccessful the use of activated carbon has also given disappointing results. During one of our most severe taste and odor periods in 1949 we tried the use of chlorine dioxide. At first the results appeared to be good but later proved to be inconclusive, because when we had used up our test supply of sodium chlorite the taste had also disappeared.

Fluoridation

The author has had no experience in fluoridation. He merely wishes to state here that Austin now has the necessary feeding equipment on order for starting the addition of fluoride. Since our water supply already contains approximately 0.2 ppm. of fluoride the present plan is to increase this only to about 0.8 to 1.0 ppm. Recent data seems to indicate that this will be sufficient for adequate protection in climates such as ours where relatively large quantities of water are consumed. Because of the lower cost of sodium silico fluoride we will probably try its use rather than the more costly sodium fluoride. The State Health Department has already given its approval to this plan.

In the next article the author will give a summary of his experiences in treating medium soft, very soft and medium hard waters.

Manual of British Water Supply Practice

Compiled by the Institution of Water Engineers, and edited by Aubrey Thomas Hobbs, the "MANUAL OF BRITISH WATER SUPPLY PRACTICE" made its appearance late in 1950. Work on the volume was undertaken in 1948 with more than a hundred experienced water engineers and other specialists taking part in preparing the manual to cover the subject in all its aspects.

A work of this nature has never been attempted before in Great Britain and while the manual deals with British practice, it does make reference to foreign practice and research where such references are appropriate for comparison. (The volume was, of course, published almost concurrently with the 2nd Ed. of the AWWA Manual of Water Quality and Treatment, and therefore makes no reference to it, although the subject matter of the two are quite similar in many respects.)

Containing 910 pages, the British Manual is a larger book than its American counterpart and obviously contains chapters on certain phases of water supply, not concerned with quality and treatment. Included in its 25 chapters are the following: Historical Development; Water Works Planning; Hydrology; Hydrogeology; Hydraulics; Reservoirs; River Works and Intakes; Aqueducts; Wells; Pumping Plant and Buildings; Treatment Plant Design, Maintenance and Operation; Elevated Storage, Boosting; Distribution Systems; Services; Hygiene; Laboratory Analysis (3 chapters); Filtration and Sterilization; Softening; Pollution Prevention; Law of Water Supply; Financing; and Organization and Management. An appendix includes a list of British Standards relating to water supply. Almost every chapter contains from 8 to 10 or 12 sections which are carefully presented, discussed, and documented. Each chapter has its own bibliography. One hundred eleven illustrations are used in presenting the text material.

In addition to being of interest to water engineers, the volume is of interest to chemistry bacteriologists, biologists, geologists, and other persons concerned in water supply.

The "British Manual of Water Supply Practice" was published for The Institution of Water Engineers, by W. Heffner & Sons, Ltd., Cambridge, Eng., and the volume retails for 50 s net. [In the U.S.A. copies are available at the office of the Am. Water Works Assn., 521 Fifth Ave., New York 17, N.Y. at $7.50 per copy.]

Graphical Approach to Statistics*

*V—Tests for Statistical Significance (Concluded)***

by C. J. VELZ, *Chairman, Dept. of Public Health Statistics*
School of Public Health, University of Michigan

(Part V continued from June issue p. 265)

Overlapping Test

Statistical significance of the difference between two series of data can readily be evaluated by the overlapping test. In comparing two series, the first operation is to differentiate them by plotting both on the same probability paper. However, it is not sufficient to demonstrate two distinct distribution lines to be confident that there is a statistically significant difference between the two series. We expect, by chance alone, that there will be shifts in the distribution lines upward and downward in plotting similar repeated sample series. Hence, to demonstrate a statistically significant difference, two distributions must remain beyond such shifts in position which chance alone can reasonably be expected to produce.

The Standard Error (S.E.) of the Mean is one measure of such shifts in a distribution line.

$$\underset{(\text{Mean})}{\text{SE}} = \frac{\sigma}{\sqrt{n}} \qquad (1)$$

The proper evaluation of data in sewage works operation and stream pollution studies cannot be accomplished by simple mathematical averages of a series of analytical results. "Statistical evaluation offers the only means of condensing raw data to concise form, permitting significant interpretation," according to the author. This series of articles on the "Graphical Approach to Statistics," has been prepared especially for *Water & Sewage Works* to show how the usual forbidding methods of statistics can be used by means of graphic solutions. These articles may well revolutionize future work in this field with particular reference to water and sewage analysis for chemical and bacteriological constituents. —The Editors.

The stability or reliability of the mean, as defined by its standard error, varies directly as the standard deviation (σ) of the individual measurements and inversely as the square root of the number of measurements in the series. The variability of the individual measurements is inherent in the phenomenon being observed and not much can be done about this. However, it is possible to control the reliability of a mean simply by increasing the number of individual measurements. Increasing the number of measurements four fold reduces the S E of the mean by ½; 16 fold by ¼; etc.; or more generally from the transformation of equation (1), the number of individual measurements required for a specified standard error of the mean is given by

$$n = \frac{\sigma^2}{(\text{S E})^2} \qquad (2)$$

For example (Referring to Fig. 26), the mean ($\bar{Y}$) and standard deviation (σ) as determined graphically are 135 and 34 Thd. lb. per day respectively for the series involving 30 individual measurements. From this single series it is then possible to

*Previous sections of this series appeared in May, August, and October 1950 and in February 1951.

**The first half of Part V appeared in June 1951.

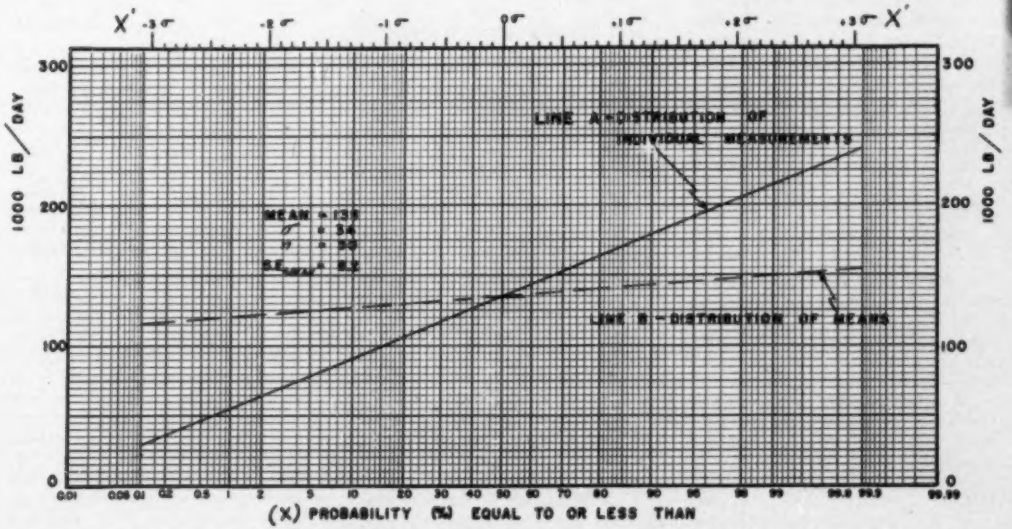

X' -3σ -2σ -1σ 0σ +1σ +2σ +3σ X'
300
200
100
0
1000 LB/DAY
LINE A—DISTRIBUTION OF INDIVIDUAL MEASUREMENTS
LINE B—DISTRIBUTION OF MEANS
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
(X) PROBABILITY (%) EQUAL TO OR LESS THAN

Fig. 26—Distribution of individual measurements and the distribution of means—suspended solids, Buffalo, N.Y. sewage, Nov. 1939.

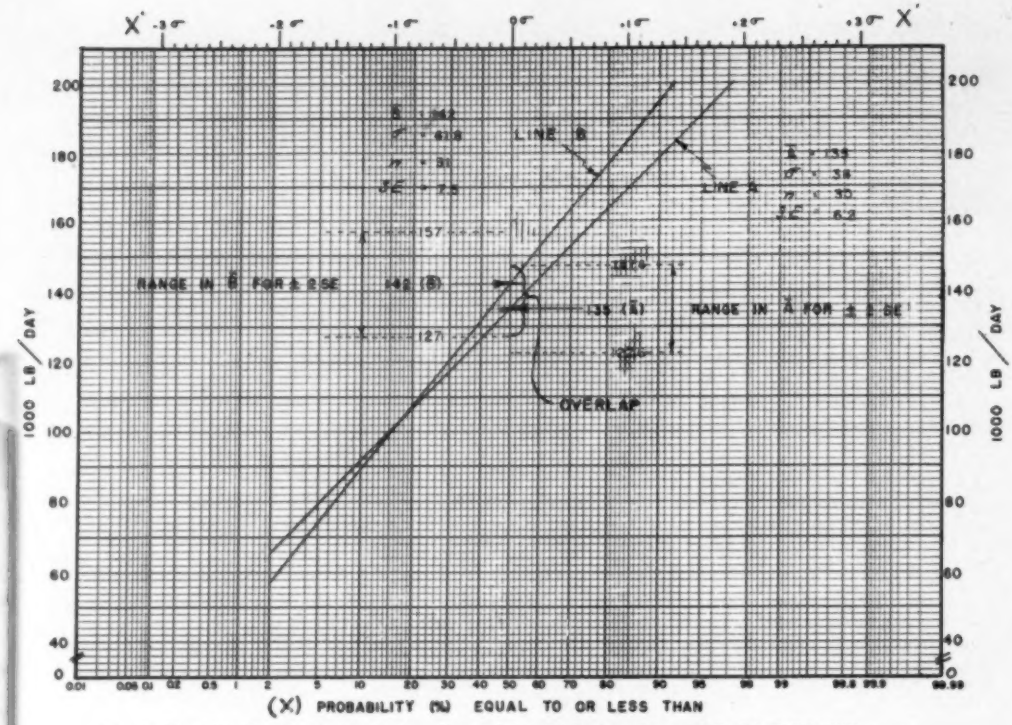


Fig. 27—Illustration of overlapping test between Nov. and Jan. distributions of suspended solids, Buffalo, N.Y. sewage.

evaluate the reliability of the mean

$$\text{S E (Mean)} = \frac{\sigma}{\sqrt{n}} ; \frac{34}{\sqrt{30}} = 6.2$$

Variation of the mean, like variation of the individual measurements, follows the normal probability distribution and from this it can be expected that for repeated series of 30 measurements

68% of the means would fall within the range of
135 ± 1 S E or 135 ± 6.2;
95% of the means would fall within the range of
135 ± 2 S E or 135 ± 12.4;
99.73% of the means would fall within the range of
135 ± 3 S E or 135 ± 18.6

This defines the range in shift upward or downward that can be expected by chance alone from plotting repeated series of only 30 individual measurements made under the same conditions.

The distribution of *means* can be represented graphically on probability paper simply by laying off a line through the mean of a single series at a slope equivalent to the S E where X′ scale is in terms of S E in place of σ. The expected distribution of means from repeated series of 30 measurements is thus represented by Line B on Fig. 26. From this line, it is possible to read the range in means for any desired probability in the same manner that ranges in individual measurements can be read from Line A.

With the range in shifts of the distribution thus defined by the standard error of the mean, it is now possible to apply the overlapping test for the statistical significance of the difference between two distributions. Marking off these ranges about the mean of each series graphically discloses the variation expected by chance alone at any confidence level.

If no overlap develops between the ranges, then chance may be ruled out and the difference between the two series being compared is accepted as statistically significant.

If an overlap develops between the two ranges, or if one range encloses the other, chance cannot be ruled out, and the difference between the two series is not accepted as statistically significant.

It will be noted that the range of the mean is dependent upon a choice of a confidence level. The acceptance of a 95 per cent confidence range within which the mean is expected to vary by chance defines a specific range ± 2 S E. But ruling out chance at this range implies a risk of being wrong about 5 times in 100, as chance alone can be expected to show a mean outside the range of ± 2 S E about five times in 100. Setting a range of ± 3 S E is generally interpreted as "practically certain" to account for variation associated with chance, but even here, there is a risk of being wrong of 27 times in 10,000, as chance can be expected to show a mean outside the range of ± 3 S E about three times in a thousand. The decision as to a confidence level always rests with the investigator and will vary depending upon the nature of the problem and the consequences of being wrong.

Another factor to be considered is that the reliability of a mean can be changed by the number of individual measurements. Hence, comparison between two means, each based upon a small number of observations, may develop an overlap and for these sized series, the difference would be considered not statistically significant. Increasing the number of measurements would reduce the range and may conceivably not develop an overlap and for the larger series, the difference

then would be considered statistically significant.

Figure 27 illustrates an application of the overlapping test in comparing the suspended solids of the influent for the month of November with that of the month of January. Line A represents the distribution of the 30 individual measurements for November giving a mean of 135 and a standard deviation of 34 Thd. lb. per day. Line B represents the distribution of the 31 individual measurements for January giving a mean of 142 and a standard deviation of 41.8 Thd. lb. per day. Two distributions are formed with an apparent difference between the means of 142 — 135 or 7 Thd. lb. per day. The standard error of the means are $\frac{34}{\sqrt{30}}$ or 6.2 for November; and $\frac{41.8}{\sqrt{31}}$ or 7.5 for January. The question now is, is this difference statistically significant or can it reasonably be ascribed to chance variations associated with such small number of observations? In making a decision in this instance about chance variation in the means, we do not wish to be wrong more often than 5 times in 100. This requires defining the range in means by ±2 S E; 135 ± (2 x 6.2) or 122.6 to 147.4 for $\bar{A}$; and 142 ± (2 x 7.5) or 127 to 157 for $\bar{B}$. Laying off ± 2 S E about each mean produces a large overlapping and therefore there is *no* statistically significant difference between the two distributions. Chance alone can easily account for the apparent difference, in fact the positions of the two lines could reverse themselves; November could be above January.

Figure 28 is a second illustration of the application of the overlapping test. Line A represents again the distribution of the influent suspended solids for November, while Line B represents the suspended solids of the effluent for November. The mean of the influent is 135 with a S E of 6.2 Trd. lb. per day, while the the effluent mean is 64 with a S E of 4.7 Thr. lb. per day. As is to be expected, there is a substantial difference between the influent and the effluent distribution lines (135 — 64)) or 71 Thd. lb. per day. In this instance, we wish to be "practically certain" (99.73%) that the difference is beyond what can be ascribed to chance. This defines a range about the means of ± S E. Laying off ± 3 S E about each of the means does *not* produce an overlapping, in fact a considerable gap still separates the two distributions and hence, we conclude that there *is* a statistically significant difference.

Since in this illustration we are comparing influent and effluent, an opportunity is afforded to appraise the monthly efficiency of the treatment works. The most probable efficiency would be that reflected by the difference between the two means, a removal of (135 — 64) or 71 Thd. lb. per day or an efficiency of 71/135 or 52.5%. A very severe criterion by which monthly efficiency could be judged would be to compare the lowest range of the influent with the highest range of the effluent. This would give a removal of (116.4 — 78.1) or 38.3, an efficiency of 38.3 ÷ 116.4 or 33%.

Another approach to efficiency would be to compare each daily influent and effluent and then plot the daily efficiencies on probability paper to define the nature of the daily variation, as shown in Fig. 29. Here the graphical mean daily efficiency for the month is 53%, which is in close agreement with the 52.5% previously determined from monthly mean results. It will be observed from Fig. 29 that there is considerable variation in day to day efficiency with a standard deviation of 12.7%.

Number of Measurements Controlling Reliability of Mean

Frequently one is asked the question, how many measurements are necessary? The answer to this depends upon what reliability will be accepted and also foreknowledge of the nature of the inherent variability of the individual measurements. The first is a matter of decision, the second may be estimated from previous experience or from a trial run. Take, for example, the monthly mean influent suspended solids for November, 135 Thd. lb. per day with a standard deviation of 34. If it is decided to control the variation of the mean to a standard error of 2, how many individual measurements will be required? Accepting the trial σ of 34 and the specified S E of 2, the required number of indivdual measurements is then readily determined from equation (2)

$$n = \frac{\sigma^2}{(S\,E)^2} \text{ or } \frac{34^2}{2^2} \text{ or } 289.$$

Or let us suppose it is decided to be "practically certain" that the mean would not vary more than ± Thd.

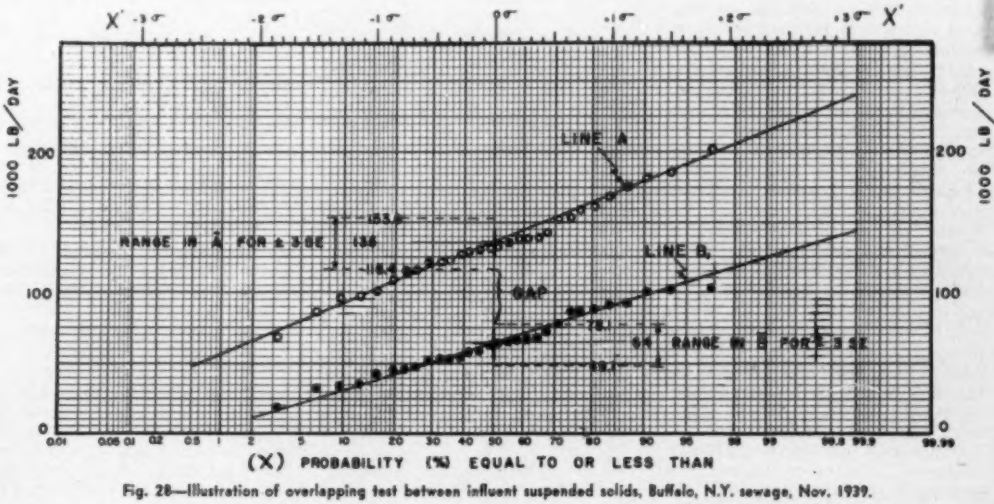

X' -3σ -2σ -1σ 0σ +1σ +2σ +3σ X'
1000 LB/DAY
200
100
0
LINE A
LINE B
RANGE IN Ā FOR ± 3 SE 135
GAP
RANGE IN B̄ FOR ± 3 SE
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
(X) PROBABILITY (%) EQUAL TO OR LESS THAN

Fig. 28—Illustration of overlapping test between influent suspended solids, Buffalo, N.Y. sewage, Nov. 1939.

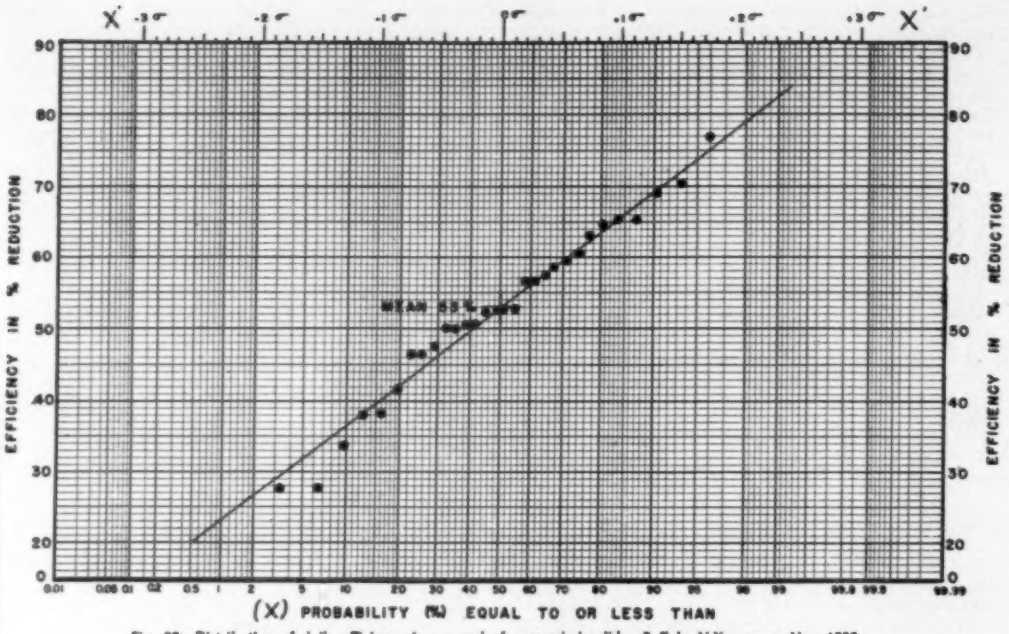


Fig. 29—Distribution of daily efficiency in removal of suspended solids—Buffalo, N.Y. sewage, Nov. 1939.

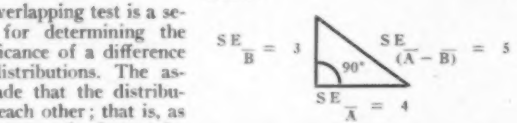
lb. per day. "Practically certain" is equivalent to $\pm$ 3 S E and hence 3 S E = 3, or the required S E is 1. For this specification

$$n = \frac{34^2}{1^2} = 1156$$

Difference Between Two Means

The simple overlapping test is a severe criterion for determining the statistical significance of a difference between two distributions. The assumption is made that the distributions approach each other; that is, as the smaller increases, the larger decreases. This requires a relative shift of 180° and hence the distance required to keep the distributions from overlapping is some increment of the sum of the Standard Errors of the two distributions. For example, if the Standard Error of the mean of Series A is 4 units and that of Series B is 3 units, 68 per cent certainty of a statistically significant difference would require the two distributions to be at least 3 + 4 units apart; 95 per cent certainty, 2(3 + 4) apart; and "Practically Certainty" (99.73 percent), 3(3 + 4) apart. The overlapping test, therefore, defines the Standard Error of a *difference* between two means as the sum of Standard Errors of the two means.

If two series are free to shift independently of each other, they need not necessarily always vary by 180°. Actually the independent shifting of two distributions may conceivably have an average variation in relation to each other at 90°. The relative difference between two means then would be equivalent to the hypotenuse of the right triangle with the legs comprised of the two Standard Errors of the means.



Now the Standard Error of the difference between the two means is the square root of the sum of the squares of the two Standard Errors of the means, which is the hypotenuse distance

$$S E_{\bar{A}-\bar{B}} = \sqrt{(S E_{\bar{A}})^2 + (S E_{\bar{B}})^2}$$

or in the example:

$$\sqrt{4^2 + 3^2} = \sqrt{25} = 5$$

It will be noted that while the Standard Error of the difference between the two means by the overlapping test is 3 + 4 or 7, by assuming complete independence the Standard Error of the difference is

$$\sqrt{3^2 + 4^2} \text{ or } 5.$$

Thus the overlapping test is unduly severe.

Assuming the independence between two means, employing the hypotenuse as the unit of Standard Error of the difference, the test for statistical significance between two means would proceed as follows:

1. Plot the two distributions to test for normality.
2. If normal, obtain the mean and standard deviation (σ) of each series.
3. Compute the Standard Error of each mean.

$$S E_{Mean} = \frac{\sigma}{\sqrt{n}}$$

4. Compute the Standard Error of the difference between the two means.

$$S E_{Difference} \sqrt{(S E_{Mean_1})^2 + (S E_{Mean_2})^2}$$

5. Obtain the difference between the two means.
6. Decide upon a confidence level for test criteria, 95 percent certainty, or 99.73 per cent or any other level desired.
7. Apply the test for statistical significance of the difference.

For example, 95 per cent certainty:

Subtract from the difference, 2 times the Standard Error of the difference and, if a positive difference remains, it can be concluded that the difference is statistically significant at

this level of confidence. If, after subtracting, no positive difference remains or if a negative value occurs, then the difference was completely washed out by chance alone and it can be concluded that the apparent difference between the two means is *not* statisticaly significant.

Applying this criterion to the two illustrations employed in the overlapping test: From Fig. 27

Series A (November) Series B (January)
Mean = 135 Mean = 142
$S\frac{E}{A} = 6.2$ $S\frac{E}{B} = 7.5$

Difference = 142 − 135 = 7

$$S\frac{E}{(Difference)} = \sqrt{6.2^2 + 7.5^2} = 9.7$$

Test at 95% certainty:

$$7 - (2 \times 9.7) = -12.4$$

The difference is completely washed out by chance alone, therefore the apparent difference is *not* statistically significant.

From Figure 28.

Series A Influent Series B Effluent
Mean = 135 Mean = 64
$S\frac{E}{A} = 6.2$ $S\frac{E}{B} = 4.7$

Difference = 135 − 64 = 71

$$S\frac{E}{(Difference)} = \sqrt{6.2^2 + 4.7^2} = 7.8$$

Test at (99.73%) "Practical Certainty":

$$71 - (3 \times 7.8) = \pm 47.6$$

A substantial positive difference remains after deducting practically all that can be accounted for by chance, therefore there *is* a statistically significant difference.

Historical

In concluding this series, reference to a few pioneering applications of statistics to sanitary engineering is appropriate. The profession is indebted to the early pioneering work of Professor Earle B. Phelps who made wide use of statistical tools; to the late Allen Hazen for his development of probability paper and its application to storage requirements and to flood probability; to Professor Gordon M. Fair for his early use of statistics as a research tool; to C. E. Keefer for his early application of probability paper to evaluation of sewage treatment operating data; and more recently to Professor E. J. Gumbel for his development of standard distribution of extreme values.

In preparation of this series, the writer wishes gratefully to acknowledge the assistance rendered by three Georges: i.e., Symons, (Man. Ed., *Water & Sewage Works*), Fynn (Ch. Chem., Buffalo Sewer Authority) and Hazey (Ch. Oper. Filter Plant, Wyandotte, Mich.) for supplying a considerable volume of data for analysis. The writer wishes, also, gratefully to acknowledge the extensive and painstaking computations of Mrs. Mildred Harter.

Johns Hopkins Advances Renn to Full Professorship

Dr. Charles E. Renn, associate professor of Sanitary Engineering at The Johns Hopkins University, has been appointed to a full professorship, it was announced by Dr. Detlev W. Bronk, president of the University.

Dr. Renn came to Johns Hopkins in 1946 to head new sanitary engineering laboratories, designed for investigation of water supplies, sewage disposal, stream pollution surveys, and industrial waste treatment. Dr. Renn has also been appointed by Governor McKeldin of Maryland to the chairmanship of a special advisory committee on conservation to work with the Maryland Tidewater Fisheries Commission.

Before coming to Johns Hopkins, Dr. Renn was a sanitary biologist for the Massachusetts Department of Public Health, a lecturer at Harvard University, and later a microbiologist at the Woods Hole Oceanographic Institution. At present, he is heading a group investigating industrial waste disposal for the National Research Council, and serves in an advisory and consulting capacity to other organizations.

Garbage Disposers Installed in Mount Dora, Fla.

The South's first town-wide installation of electric garbage disposers was begun this spring in the Florida resort community of Mount Dora.

In an attempt to improve sanitation and simplify garbage collection, Mount Dora signed a contract to buy General Electric "Disposalls" for resale to local householders at a special price of $99.95 installed.

It is hoped that every one of the town's 1500 householders will eventually install disposers, but they will not be compelled to do so.

The town is buying the disposers and selling them direct to homeowners, who can pay cash or finance their purchase through the local bank. Three local plumbers and two local electricians are making the installations.

According to Mayor D. F. Crane, at present the town is charging householders $9 a year, or 75 cents a month, for garbage and refuse collection. The bill will be cut in half for people who install disposers, and henceforth they will pay only for trash collection. Although Mount Dora has a sewer system 90 per cent of its houses are connected to septic tanks.

"Lew" Birdsall Retires

Lewis I. Birdsall, Aluminum Sulfate Specialist, of the General Chemical Div. of Allied Chem. and Dye Corp. retired on May 1. "Lew" Birdsall who was one of the "Bartow's Boys" of the Illinois State Water Survey in the first decade of this century has had a long and distinguished record as on "Ambassador of Commerce." The high esteem with which "Lew" is held by water works men, was evidenced by the action of the Illinois Section of AWWA when it cited him for the Fuller Award in 1950. His activities in the Section work were thus rewarded. While his plans are as yet indefinite, his many, many friends particularly throughout the midwest and the Illinois Section hope that he will still be available for participation in the affairs of the water works fraternity.

The Home-Stretch

It's not the first mile-post but the last that tells the story when it comes to deciding the winner of the race.

Design of Main Extensions of Small Size

Where No Fire Service is Required

by D. R. TAYLOR, *General Manager, Baton Rouge Water Works Co. Baton Rouge, Louisiana*

ALL public water utilities are occasionally confronted with the necessity of making main extensions. Where fire protection is required, design techniques and methods have been more or less standardized and generally accepted. Frequently, however, for numerous reasons well known to the profession, only domestic service will be required for a long time or at least for several years and a small main extension is decided upon.

To design a main extension for domestic service only, the maximum domestic demand must be known. During the last decade much attention has been given this subject. With the use of the Meter Master, many tests have been and are still being made in many sections, to determine maximum domestic demand, and the results vary so greatly that it is difficult to form a conclusion. The difference of climatic conditions in various sections will of course affect the results, but, a considerable variance has been found also in the same section in several parts of the country.

Property Classification and Water Consumption

For several years tests have been conducted in Baton Rouge by metering the total consumption of various numbers of residences of various classifications of property in an effort to determine maximum domestic demand. The Meter Master has been used in each test to record the various rates of flow. It has been desired to determine the maximum demand during the longest, hottest, driest, period that might occur within ten years, when lawn sprinkling reached a maximum. The ten year period was considered to be reasonable and practical. While several droughts occurred during the period of the tests, none was considered to be the ten year maximum. Realizing that lawn sprinkling can increase the demand enormously, a substantial percentage was added to the results to simulate maximum drought conditions for such a period.

While the rates shown, have proved sufficient for this locality, it is felt that subsequent tests may suggest some slight downward revision for the larger numbers of houses in Classes 3 and 4. Based on these rates, however, a review of the design of more than twenty miles of small main extensions ranging in length from 100 to 3000 ft., installed during the last five years, has proved that these rates are adequate.

In Table 1, Class 1 may be of little use to the average city, on the other hand the author has assisted several small towns with populations of less than 5000 that were more rural than urban, where prospective customers desired only a minimum of service and where either they could afford very little expense for the main extension or the town had practically nothing in its budget to defray the expense of the installation. In these instances, Class 1 rates were satisfactory to all concerned. This class is included for those who are forced to resort to its use.

Table 1

Maximum Domestic Demand in G.P.M.

For various types of houses with tank-type toilets.

Number of Houses	CLASS OF PROPERTY			
	1	2	3	4
1	10	12	14	19
2	12	15	18	24
3	14	17	20	27
4	16	19	22	30
6	18	21	25	34
8	20	23	28	37
10	21	25	30	40
15	25	30	37	50
20	28	35	43	58
25	30	39	48	66
30	31	42	53	73
40	36	48	62	85
50	40	54	70	96
60	43	59	76	105
70	45	62	82	115
80	48	68	88	125
90	50	71	94	132
100	52	75	100	140
125	57	83	110	157
150	61	90	120	175
175	64	97	132	190
200	68	105	140	205
300	80	125	175	250
400	90	145	200	295
500	100	160	225	335

DESCRIPTION

CLASS 1 Sub-Standard houses with barest minimum of plumbing where little or no lawn sprinkling is expected.

CLASS 2 Small houses with one bath, on small lot. Small rental houses and small rental duplex houses. Very little lawn sprinkling. Either side of a duplex is considered as one house.

CLASS 3 Average good sub-division with 80% two to three bedroom houses with one bath and 20% two to three bedroom houses with two baths. Houses owned by occupant, with average amount of lawn and shrubbery requiring average amount of lawn sprinkling.

CLASS 4 Houses with three to four bedrooms and two to three baths on large lots requiring considerable lawn sprinkling. Does not include estates with or without swimming pools.

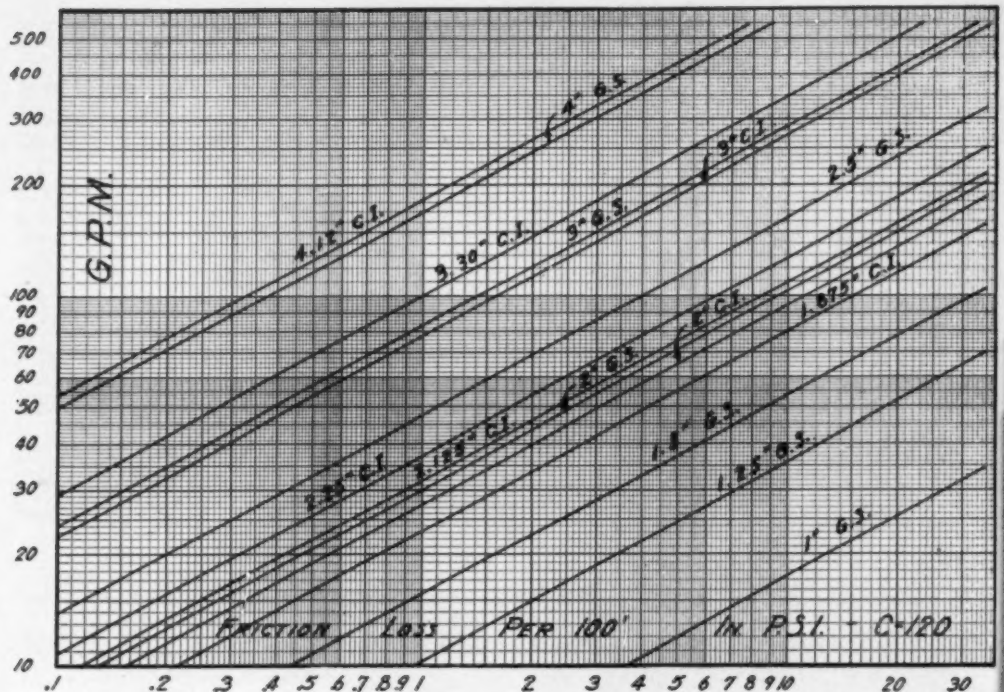


Fig. 1—Loss-of-Head in PSI per 100 ft. of Pipe With "C" = 120

Loss of Head in Pipe

In Baton Rouge, raw water from deep wells has a total hardness of zero, a total alkalinity of 170, of which 150 ppm. is due to bicarbonates, a pH of 8.7 and requires no treatment. Mains 20 years old have a C of 120 or more.

The losses of head in Fig. 1 are based on actual inside diameter instead of nominal diameter. The sizes marked G. S. represent galvanized standard weight steel pipe. While all sizes of steel pipe are designated by nominal diameter, the various sizes of cast iron pipe are designated by actual diameter. This has been done for the following reason: All standard weight steel pipe is made to the same specifications by the various manufacturers, but the inside diameter of some small sizes of cast iron pipe varies with different manufacturers. Therefore, it seems appropriate to indicate the nominal diameter of galvanized steel pipe and actual diameter of cast iron pipe. In any event the actual diameter of the pipe being considered should be known. If it is desired to design with a C other than 120, the values in Fig. 1 should be multiplied by the proper multiplier shown in the following table:

Value of C	140	130	120	110	100
Multiplier	.75	.86	1.0	1.17	1.4

The small sizes of cast iron pipe are very popular for small main extensions because of the cast iron permanence and because of this small cast iron pipe can be salvaged, when replaced with larger mains to provide fire protection, and reused as often or as long as desired.

The curve in Fig. 2 was derived from the formula,

$$F = \frac{\Sigma N^m}{N^{m+1}}$$

Where N = Number of houses
m = 1.85

This formula was designed to determine the total friction loss in a pipe line with any number of outlets, an equal distance apart and all discharging at the same rate. (When N=1, F=1) It may be considered that these two conditions are satisfied when all of the lots are of the same width and all of the houses are of the same class. A slight variation in these conditions on a relatively short extension of one size will make little difference.

There may be rare instances, especially on a long extension, consisting of two sizes of pipe, when there may be some considerable variance in these two conditions along the extension or the width of the lots and/or class of houses may be different at either end of the extension. In such instances the use of a little practical judgment in making reasonable prorations to fit the conditions, will provide satisfactory results. In this case "N" is designated as the "number of houses," assuming that there is a separated outlet (tap) for each house.

When taps for two houses on opposite sides of the street are very close together on the main they should be considered as one "outlet" or "house" and the rate per house multiplied by two. For instance, if this condition existed for 40 houses (20 on either side of the street) on fifty foot lots along an extension 1000 ft. long, it should be considered that N=40÷2=20. If these were Class 3 houses the rate per house (from Table 1) would equal 62÷20=3.1 gpm.

The amount of residual pressure to be provided at the tap is a matter of opinion or policy. It may vary from 25 psi. for single story Class 2 houses to 40 psi. for two story Class 4 houses.

Total friction loss in a main extension for domestic service, expressed in pounds per square inch, equals length of the extension in hundreds

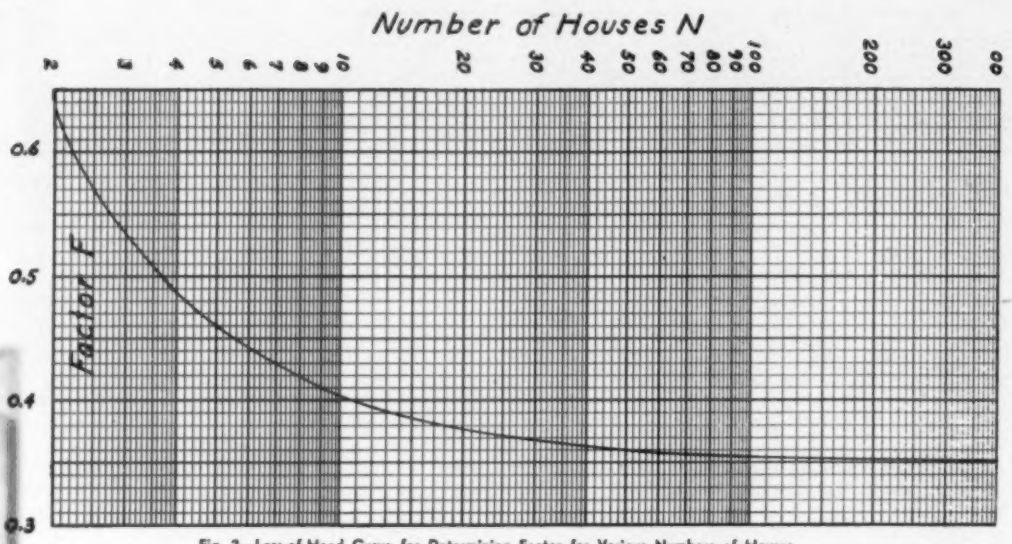


Fig. 2—Loss-of-Head Curve for Determining Factor for Various Numbers of Houses.

of feet, times friction loss per 100 ft. in pounds per square inch, times factor (F). For example, assume that a 2-in. G.S. main with a C of 120, 500 ft. long, fed from only one end, serving 10 houses, has a maximum demand of 40 gallons per minute. What is the total friction loss in this main? From Fig. 1, friction loss for 2-in. G.S. pipe at 40 gpm. is 1.7 pounds per square inch per 100 ft. and from Fig. 2, for 10 houses F is .404. Therefore, total friction loss=5×1.7×.404=3.43 psi.

The Design Process

Problem 1: A 1500 ft. main extension is required to serve 60 Class 2 houses on 50 ft. lots (30 on either side of the street) and the main will be fed from both ends. The daily minimum distribution system pressure is 50 psi. and a residual pressure of 30 psi. is desired at each tap. Therefore, only 20 psi. can be allowed for friction loss, 50—30=20. Assume that 1½ in. galvanized steel pipe with a C of 100 will be required.

1st Trial Calculation

From Table 1, maximum demand for 60 Class 2 houses = 59 gpm.
From Fig. 1, friction loss through 1½ in. G.S. pipe for 59 gpm. = 11.8 psi per 100 ft.
From. Fig. 2, for 60 houses, F = 0.358.

Values in Fig. 1 are for a C of 120 and must be multiplied by 1.4 for a C of 100. This extension will be fed from both ends, therefore the total friction loss calculated as if it were fed only from one end must be divided by $2^{1.85}$ i.e., (3.6.) or multiplied by the reciprocal of $2^{1.85}$ i.e., (.278).

Total friction loss
$15 \times 11.8 \times 1.4 \times .358 \times .278 = 24.66$ psi.

This exceeds the friction loss of 20 psi. that can be allowed, so the calculation should be repeated for pipe a size larger, as for instance 2 in. cast iron pipe.

2nd Trial Calculation

From Fig. 1, friction loss through 2 in. C. I. pipe for 59 gpm.
= 4.2 psi. per 100 ft.
Total friction loss
$= 15 \times 4.2 \times 1.4 \times .358 \times .278 = 8.75$ psi.

A 2 in. cast iron main will satisfy the maximum demand with a residual pressure of approximately 41.25 psi. at the taps.

Problem 2: A 3000 ft. extension is required to serve 120 Class 3 residences on 50 ft. lots. The daily minimum distribution system pressure is 60 psi. and a residual pressure of 35 psi. is desired at each tap. Therefore, only 25 psi. can be allowed for friction loss, 60—35=25.

From Table 1, maximum demand for 120 Class 3 houses=108 gpm.* Assume that 1500 ft. of 3.30 in. cast iron and 1500 ft. of 2⅛ in. cast iron pipe with a C of 120 will be required.

1st Trial Calculation

1500 ÷ 50 × 2 = 60 houses on 3.30 in. main
1500 ÷ 50 × 2 = 60 houses on 2⅛ in. main
108 ÷ 120 = 0.9 gpm. per house
60 × 0.9 = 54 gpm. = maximum demand for 3.30 in. pipe
60 × 0.9 = 54 gpm. = maximum demand for 2⅛ in. pipe

Average rate of flow through the 3.30 in. pipe equals influent rate, plus effluent rate, plus rate per house, divided by 2.

*By interpolation

Influent rate of 3.30 in. pipe = 108.0 gpm.
Effluent rate of 3.30 in. pipe = 54.0 gpm.
Rate per house .9 gpm.
Total 162.9 gpm.

Average rate through 3.30 in. pipe
= 162.9 ÷ 2 = 81.45 gpm.
From Fig. 1, loss through 3.30 in. pipe for 81.45 gpm.
= .67 psi. per 100 ft.
Therefore, total loss through the 3.30 in. pipe
= 15 × .67 = 10.05 psi.
From Fig. 1, loss through 2⅛ in. pipe for 54 gpm.
= 2.7 psi.
From Fig. 2, for 120 houses
F = .355
Therefore, total loss through 2⅛ in. pipe
= 15 × 2.7 × .355 = 14.35 psi.
Total loss through 3.30 in. and 2⅛ in. pipe
= 10.05 + 14.35 = 24.40 psi.

An extension consisting of 1500 ft. of 3.30 in. pipe and 1500 ft. of 2⅛ in. pipe will satisfy the maximum demand with a residual pressure of approximately 35.60 psi. at the taps.

Problem 3: A 3000 ft. extension is required to serve 120 Class 3 houses on 50 ft. lots. The daily minimum distribution system pressure is 50 psi. and a residual pressure of 25 psi. is desired at each tap. Therefore, only 25 psi. can be allowed for friction loss, 50 — 25 = 25. The taps for each pair of houses on opposite sides of the street will be made within one foot of each other, along the main. In this case the extension will be fed from *both* ends and it is desired to use as much 2 in. galvanized steel pipe as possible and as little of the next larger size as will be required.

From Table 1, maximum demand for 120 Class 3 houses = 108 gpm.

Assume that 500 ft. of 2½ in. and 2500 ft. of 2 in. galvanized steel pipe with a C of 120 will be required.

1st Trial Calculation

500 ÷ 50 = 10 houses on 2½ in. main. (Each pair of taps made close together)
2500 ÷ 50 = 50 houses on 2 in. main
10 + 50 = 60
108 ÷ 60 = 1.8 gpm. per house
10 × 1.8 = 18 gpm = maximum demand for 2½ in. pipe
50 × 1.8 = 90 gpm = maximum demand for 2 in. pipe
Influent rate of 2½ in. pipe = 108.0 gpm.
Effluent rate of 2½ in. pipe = 90.0 gpm.
Rate per house = 1.8 gpm.
Total = 199.8 gpm.
Average rate thru 2½ in. pipe = 198.8 ÷ 2 = 99.9 gpm.
From Fig. 1, loss thru 2½ in. pipe for 99.98 gpm. = 4 psi.
Therefore, total loss thru the 2½ in. pipe = 5 × 4 = 20.0 psi.
From Fig. 1, loss thru 2 in. pipe for 90 gpm. = 7.7 psi.
From Fig. 2, for 60 houses F = .358
Therefore, total loss thru the 2 in. pipe = 25 × 7.7 × .358 = 68.9 psi.
Total loss thru 2½ and 2 in. if fed from one end = 20.0 + 68.9 = 88.9 psi.
Total loss if fed from both ends = 88.9 × .278 = 24.7 psi.

This extension will satisfy the maximum demand with a residual pressure of approximately 25.3 psi.

The values shown in Table 1 are not considered to be the perfect answer. The matter of maximum domestic demand may never be reduced to an "exact science." Considerable research, however is being conducted in various sections of the country and results are looked forward to by the profession with much interest. The values used herein have been obtained in a southern state where the growing season is long and the summer temperature is high. There are many garden clubs and an amazing interest is shown in growing semi-tropical plants, including camelias which may cost as much as $50.00 each, for a rare variety, several years old. For obvious reasons there is considerable sprinkling. Therefore, these maximum domestic demand values may be slightly high for other sections of the country.

These values are offered as a basis for further study and for use in design, until such values are determined for the particular section in which they may be used, if conditions in that section require that other values be used.

New Consulting Engineering Firm

Announcement has been made of the formation of a new firm of consulting engineering associates. Known as Cotton, Pierce, Streander, Inc., Associated Engineering Consultants, the new firm resulted from the pooling of the engineering organizations of five different consulting firms. Executive offices of the organizations are located at 638 Atlantic Ave., Boston 11, Mass.

The new firm combines the facilities and staffs of The Pierce Consulting Engineering Co., of Boston; E. R. Cotton Associates of Washington, D.C.; George A. Gieseke, Philadelphia; Philip B. Streander & Affiliates, Boston; Browne and Bowers, Fair Lawn, N.J.; C. R. Hagey Engineering Co., Fort Erie, Ont., Can.; and Mira & Rosich, Havana, Cuba.

Cotton, Streander, and Gieseke are all specialists in the field of sanitary engineering; Pierce is a specialist in power plant engineering; and Bowers is a water conditioning specialist.

The newly formed group offers services in investigation and reports, design, and construction covering power, sanitation, water supply and treatment, transportation, and process work. With centralized management, but strategically located offices, the new firm offers proper and economical solution of particular problems which are presented to it.

A New York office has been established at 132 Nassau St., New York 7, N.Y. and is under the direction of Philip B. Streander, President of the new firm. The main engineering office in Boston is staffed by 35 engineers.

Mechanical Equipment Effects Faster Leak Repair, With Greater Safety

According to Jerome C. Zufelt, Supt., Water Department, Sheboygan, Wis. good service to customers and safety for workmen are two objectives of prime importance. His department has been better able to achieve both since beginning to use a hydraulic truck crane for many jobs formerly done by hand.

The machine, a Bucyrus-Erie Hydrocrane, shown in the accompanying photograph, has been found particularly valuable on leak repair work, where it has reduced repair time as much as 50 percent. For example, one leak repair required only an hour and a half to uncover the leak, do the repair work, and backfill. Zufelt estimates that with hand labor this job would have taken at least four hours.

Not only does the public benefit from shorter shut-off periods, with the crane uncovering leaks, Mr. Zufelt points out, but the repair crews can operate with greater safety as well. The men no longer have to fight quicksand and cave-ins when the crane is doing the digging. Today, with the Hydrocrane doing the hazardous work, Sheboygan's work crews regard leak repair as just another job.

The crane is also used for laying pipe, setting hydrants and valves, unloading pipe from gondola cars and loading it onto trailers for transfer to job sites or store yard.

AWWA Management Division Sessions at Miami

Second Installment of AWWA Convention Report

IN the June issue of *Water & Sewage Works,* we reported on the business sessions of the Miami Convention of AWWA, together with the story of the convention, its attendance and its non-technical sessions.

Included in that installment of the report on the convention was one section devoted to the Water Works Administration Committee and its open session. Also included in that first installment was a report on the discussion of Critical Materials, Priorities, and Allocations. Both of these sessions covered subject matter of particular interest to persons engaged in water works management, and therefore could have been reported with this currnt installment on the sessions of the Water Works Management Division of AWWA. Readers who may be interested in water works management, but who missed the previous issue, will find this material in the lead article in the June issue.

W. V. Weir
Pres.
St. Louis Co. Wat. Co.
University City, Mo.

L. J. Hoffman
Off. Mgr.
Water Works
Akron, O.

F. C. Amsbary
Vice Pres.
Ill. Wat. Serv. Co.
Champaign, Ill.

Presidents

Paul Weir
Gen. Mgr.
Water Works
Atlanta, Ga.

J. S. Longwell
Cons. Engr.
Piedmont
Calif.

A. E. Berry
Director
San. Engr. Dir.
Min. of Health
Toronto, Ont.

Meter Maintenance Costs

"METER MAINTENANCE COSTS" by Arthur P. Kuranz, Manager, Water Utility, Waukesha, Wis.

Mr. Kuranz reported on the results of a questionnaire submitted to a number of cities on the subject of meter maintenance practice and the cost of meter maintenance. Questions were asked as to the time between repairs, cleaning procedure, whether or not the meter was taken apart, if gear trains were repaired, if the register is set back to zero, testing after repair, lowest rate at which tests are made, etc.

Out of forty utilities replying, all forty test meters after they have been repaired. More than half of these utilities test meters at ¼ gpm. There was no general agreement as to how much metering repairing costs. Nineteen water utilities reported that the cost of repair parts ran between 4.6 cents and 50 cents per meter per year; four plants reported costs between 51 and 75 cents; two reported costs between 76 cents and $1.00 and two reported from $1.00 to $1.75.

Of the forty cities replying to the questionnaire, 27 or approximately 70 per cent were 100 per cent metered, and only a few cities were less than 90 per cent metered. The data collected indicated that in general, 55 per cent of the metered customers accounted for 85 per cent of the water used. Mr. Kuranz noted great improvement in metering since a similar study was made in 1941.

Meter Reading and Billing

"METER READING AND BILLING COSTS" by Kenneth K. King, Director of Public Works, Phoenix, Ariz.

In Mr. King's absence, the paper was read by DARIO TRAVAINI, Supt. of Water Production and Sewerage, Phoenix, Ariz. This paper, too, was a report on the results of a survey of cities having populations between 80,000 and 222,000. These cities were distributed geographically and included both private and public utilities and those combined with as well as separate from other utilities.

Of 96 cities queried, 71 replied, and of these, 54 fell within the limits of the study. Data from 1940, used for comparison had been obtained from 47 cities. While it was observed that the cost of service varied widely per bill, and the cost for billing also varied widely, it was noted that the cost of billing now is 110 per cent higher than in 1940.

The use of mail for billing is increasing, and stub systems seem to be more popular than ledger systems. The average cost per meter read was found to be 16.6 cents in 1950 as compared to 4.4 cents in 1940. Costs of meter reading are lower in the south because of the easy accessibility of the meters. Costs of reading meters are higher in the less densely populated cities than in those with higher population density. The report concluded with the statement that 97 per cent of the water departments now bear the cost of meter repairing.

Automotive Equipment

"AUTOMOTIVE EQUIPMENT COSTS" by James B. Ramsey, Chief Engr., & Supt., Water Dept., Kansas City, Mo.

Mr. Ramsey also reported on the results of a survey questionnaire which was answered by 24 cities between 100,000 and 200,000 population. From the study of the results obtained, it was obvious that complete records are essential to the evaluation of the information. Fourteen of the cities in the survey had complete records. Where incomplete records were kept the operating and maintenance cost of 6.44 cents per mile was 136 per cent higher than the same costs for the 14 fleets covered by complete records. Insurance costs in the 10 cities with incomplete records were 164 per cent of those in the cities which kept complete records. The total cost per mile in the ten cities was 127 per

cent of the total cost per mile in the 14 cities with complete records.

Water Rates

"WATER RATES—A COMMITTEE REPORT" by Louis E. Ayers (Chairman), Cons. Engr., Ayers, Lewis, Norris & May, Ann Arbor, Mich.

Mr. Ayers opened his discussion with the statement that the committee had been working for two years and was unable to agree; therefore his paper was not a committee report, per se, but rather a presentation of the controversial issues in the matter and his own personal views of those matters. That controversy should occur is not surprising, inasmuch as controversy over water rates has been going on since the second volume of the AWWA Journal 69 years ago; in that time, more than 300 papers have been presented on the subject.

While controversy is bound to exist, Mr. Ayers believes it can be limited to certain areas of thought, and that every city must resolve these controversies for itself.

Controversial matters involved may be divided into three groups: (1) determination of *amount of revenue*, (2) *allocation of revenue* between rate payers and taxpayers, and (3) *rate schedules* for both normal and special users.

There have been two bases used for the determination of revenue: the "utility" basis and the "cash" basis. The former is required for all privately owned water works and some municipally owned systems. This basis requires (a) the determination of a rate base and the amount of capital under which the utility is entitled to earn a return, (b) fixing a "fair" rate of return on the rate base, and (c) approval of depreciation allowances. The gross revenue under this basis includes the following: Operation and Maintenance Expense, Taxes, Depreciation, and a Rate of Return on a Rate Base.

The "cash" basis is a budget basis, and the total revenue is based on estimates of cash requirements, supported by operating experience and knowledge of future needs. The items to be included in this system may be either basic or optional. Basic items include: Operation and Maintenance, Debt Requirements, Replacements, Normal Extensions and Improvements. Optional items to include in this "cash" basis may be: Taxes, Appropriations for Major Improvements, and Contributions to Other City Departments.

On the matter of *allocation of revenue*, it has been common practice to assess some part of the cost to property. While a water works is a benefit to public health and to property values, the fixing of the amount of this benefit is not subject to analysis from a monetary standpoint, except arbitrarily and by judgement. The extent of a charge to property by a water works is practically limited, therefore, to the fire protection charge, which is, in large measure, a charge for benefit to property rather than for the commodity used.

Rate schedules have as their primary objective, the distribution of expense among customers, as nearly as practicable, in proportion to the cost of supplying the commodity. A second objective is simplicity both from the standpoint of classifying users and billing for service. Users may be classified as normal and special. While, in general, single rate schedules have been applied to all types of users, it appears to Mr. Ayers, that a differentiation is desirable, with the classification being determined by separating the demands on the load curve.

Mr. Ayers proposes two bases for the distribution of costs after deducting the charges for fire protection and special uses. These are designated as the "demand" basis and the "customer-cost" basis. The chief difference between the two is in the amount of the service charge. The demand basis has generally distributed a considerable part of all capital costs plus customer costs plus varying portions of operation and maintenance expense to customers through a service charge. The customer cost basis, limits the service charge to customer costs only.

The committee has under consideration rules for application for the "demand" basis. These rules should improve the equity of its application. The following assumptions are proposed: (1) that the total of the so-called demand costs, included in the service charge, should not be more than 50 per cent of the capital costs of depreciation, taxes, and return on the investment, with the balance of the capital costs charged to the commodity, and (2) that the demand costs be distributed to meters on the basis of ratios that reflect the actual demand of meters in groups of sizes.

The customer cost basis has been most recently promulgated by the Michigan Section. It avoids controversy over demand by leaving all capital costs in the commodity rates. The service charge thus includes, all accounting costs of reading, billing, collecting, etc. to be distributed equally between customers.—And, all customer costs, both capital and operating, connected with meters and services, to be distributed in approximate ratio of cost of the several sizes of meters.

In the past, cost distributions have allocated expense to (a) fire protection, (b) to capacity or ready to serve costs and customer costs, and (c) to commodity costs. The Michigan Section proposed a functional basis for allocating costs into: Production, Distribution, Customer Costs, and Hydrants and Connections. Such a distribution affords a basis for computation of unit rates, according to Mr. Ayers.

Compensation

"COMPENSATION OF WATER WORKS PERSONNEL — COMMITTEE REPORT" by Leon A. Smith (Chairman), Supt., Waterworks and Sewerage, Madison, Wis.

In opening his report, Mr. Smith mentioned that a survey conducted of the engineering class in which he was graduated from the Univ. of Wis., had shown that those members of the class who were in the upper half scholastically had gone into professional engineering. Those members in the lower half of the class had gone into business and contracting. The latter group had much higher incomes 25 years later than did the upper half of the class.

Mr. Smith also noted that 15 years ago, professional people received incomes of 8 to 10 times that of labor on an engineering job. Today professional salaries are only from 3 to 5 times that of labor.

M. B. Cunningham
Supt. & Engr.
Water Dept.
Oklahoma City

J. G. Simmons
Plant Supt.
Water Co.
W. Palm Beach, Fla.

Associate Presiders

H. L. Berkstresser
Supt.
Water & Sewers
Panama City, Fla.

C. H. Capen
Chief Engr.
No. Jer. Wat. Dist.
Wanaque, N. J.

This report resulted from a questionnaire sent to 500 cities of which 280 replied. The sizes of the communities ran from under 5000 to over 1 million population. Inquiries were made about the following position categories: Manager or Supt., Chief Engr., Office Mgr., Production Group, Distribution Foreman, Purification group, and Meter Readers.

Twelve cities were under 5000, 61 cities were between 10,000 and 30,000, 39 were between 30,000 and 50,000; 53 were from 50,000 to 100,000, and 28 were in the 100,000 to 500,000 range. Eighty-five per cent of these were municipally owned utilities. The data were analyzed geographically.

In general, cities under 50,000 have a 44 hour work week; cities above 50,000 have a 40 hour work week. While the number of employees varies considerably for a number of reasons from city to city, the average shows that there is approximately 1 employee for each 1000 persons served. On the average there is one customer for every five persons served.

Salaries vary widely and as might be expected are lower in the smaller communities. Geographical location and cost of living have their effects on the salary levels. In the managerial category, salaries in the large cities are 3.5 times as much as those in the small cities. In the meter reader category, salaries in the large cities are only 1.5 times those in the small cities.

Vacations, sick leave, pension plans, and social security all have an effect on the actual salaries paid in the various categories. Private companies usually pay higher wages and salaries than do municipalities of comparable size. It is quite common to pay time and a half for overtime, but not for administrative personnel.

Mr. Smith closed with the observation that this was but a preliminary report, that wages are not frozen to date. "To attract good men, we must do something drastic" were the final words of the chairman, indicating that he felt that wages and salaries for water works personnel are not high enough and can not compete with private industry.

Utility Changes in State Highways

"Payment of the Cost of Utility Changes in State Highways" by Harry B. Shaw, Deputy Chief Engr., Washington Suburban Sanitary Dist., Hyattsville, Md.

The problem of relaying water mains because of changes in state highway locations or improvements, has raised the question of who should pay for the changes necessary in the water mains. Inasmuch as the utility has to make the change, for the benefit of another agency, a number of municipalities have objected to paying the cost of such utility changes. The problem has been discussed before at the Chicago Convention where speakers from California and New Jersey reported on the practices in their states. Mr. Shaw, who is faced with the problem has gone further in an endeavor to learn what should be done. He has queried the attorneys-general of all of the states. Thirty-three states replied to the questionnaire.

In all states except 4, the utility has to pay the cost of main moving if the main is laid in the state highway, but practically all of the states pay the cost if the mains were originally laid in private property which has since been acquired by the state for highway purposes.

Quoting laws and legal opinions, Mr. Shaw showed that there is no rhyme or reason to the legal status of the problem. Most laws are not dynamic and should be examined and revised to make them adequate. Mr. Shaw does not believe that the utility should be penalized if the main is in the highway—it is better there than elsewhere and serves the public just as does the highway. "Why penalize the utility if the highway is the sole beneficiary. It is proper that those who benefit should pay the cost." According to Mr. Shaw, there is no legal basis for any other concept, and the laws do not make good sense if they indicate otherwise.

A questionnaire to water works managers brought back 40 replies which showed that 13 favored the utility paying the cost, 10 believe in sharing the cost, and 17 believed that the state should pay all such costs. While there is no national figure available as to the costs of the changes being necessitated by highway improvement, Mr. Shaw pointed out that it is quite high in a number of individual cases. In the State of Maine, $105,871.96 had been spent by utilities in three years. Prividence, R.I. had spent more than $90,000; Haggerstown, Md., a city of 40,000 persons had spent $57,856.71; and the Washington Supburban San. Dist. had spent more than $97,000 in three years. Mr. Shaw believes that the aggregate cost for the country must be astounding. He suggests that the problem should be studied locally and pressed for solution in the state legislatures; he also believes that the AWWA should set up a committee to work on the problem.

Programmers

A. P. Kuranz
Mgr.
Water Util.
Waukesha, Wis.

L. E. Ayres
Cons. Engr.
Ann Arbor,
Mich.

L. A. Smith
Supt.
Wat. & Sew.
Madison, Wis.

H. B. Shaw
Dep. Ch. Engr.
Wash. Sub. San. Dist.
Hyattsville, Md.

Safety

"Safety Program for Water Works—Committee Report" by Raymond J. Faust (Chairman), Exec. Asst. Secy., Amer. Water Works Assn., New York City.

Mr. Faust reported on the results of a survey questionnaire sent to 300 cities in the country inquiring about the present safety practices in the water works industry. Questionnaires went to cities of more than 10,000 population. The number of replies received totalled 151, roughly 50 per cent of the cities queried.

Mr. Faust handed out mimeographed sheets showing the results of the tabulations of the questionnaires. (These sheets may be obtained from the AWWA office in New York.) Eleven questions were asked. Answers to the first question: "Does the utility have an active safety program?" showed 41 per cent yes, but with the larger cities more safety conscious than the smaller ones. (There are glaring weaknesses in all categories, however.) Only ten per cent of the municipalities have a full time safety director, while 38 per cent have an employee who devotes part time to safety work. In 26.5 per cent of the cities, the services of a city employed safety director are available.

The questionnaire replies indicated that 34 water utilities are members of the National Safety Council, but these are the only 34 members actually in the Council, so that the percentage

relation of these cities to the total number replying (22.5 per cent) has no relation to the actual situation throughout the country. While only 34 water utilities belong to the NSC, 47 cities belong. Mr. Faust suggests that the utilities should utilize the cities' memberships.

Where safety programs are in operation, the results show that 81 per cent have been effective in reducing accidents. Too few utilities make use of safety meetings (27 per cent) and of safety bulletins (29 per cent).

A study of accident experience for the past three years shows 0.116 accidents per worker year or a ratio of one accident per year to each 8.6 employees. The Nat. Safety Council records for the 34 utilities which belong to the Council, show that the water works has a frequency rate of 33 compared with the commercial, electrical, and gas-industries national average of 10.14 for 741 reporting industries. The severity rate for water works, however is only 0.9 compared with the national average of 1.02.

Mr. Faust believes that the water works industry is not safety conscious, that there should be a thorough study of the present practice, that a safety program should be developed for the industry, and that the AWWA should join the National Safety Council. (Ed. Note: At the session of the Water Works Administration Committee, the audience voted strongly in favor of all of these ideas when Mr. Faust presented them in brief form).

Rates for Low Load Factor Water Users

Was the subject of a Panel Discussion presided over by MELVIN P. HATCHER, Director of Water, Kansas City, Mo., who introduced the topic by suggesting that probably demand meters might prove the end answer in determining the proper water rate for customers with wide variations in demand rates of water for various purposes. Another possibility would be the establishment of a "surcharge" based on maximum demands such as could be derived from the installed capacity of refrigeration and air cooling equipment. To determine demand patterns in Kansas City they had surveyed customers by placing recording meters on services, with some surprising findings resulting.

LOUIS E. AYRES, Consulting Engr. of Ann Arbor, Mich., as chairman of A.W.W.A.'s Committee on Water Rates, stated that air-conditioning equipment required 75,000 to 100,000 gal. of water per year per ton of refrigeration capacity. It is proposed to establish special rates for customers demanding three to four times as much water in one season as compared to another. Such rates would be based on extra capital investment required to provide the high demand.

W. VICTOR WEIR, president of the Association, pointed out that air-conditioning interests were feeling discriminated against when, as a point of interest the lawn sprinkling load was actually much worse—namely, 10 or more times the average rate to domestic customers in comparison with a five fold rate for air-conditioning.

E. J. TAYLOR, Chief of Philadelphia's Water Bureau, stated that there were no restrictions on water use for refrigeration equipment up to 20 hp. plants. They had found no exact capacity of air-conditioning units beyond which one can be certain that installation of water conservation equipment will prove a profitable investment for the customer.

E. F. TANGHE, Supt. of Water, Milwaukee, was of the opinion that in water rate structures the ideal would be similar to electric rates in which a combination of commodity and capacity and demand charges is involved. In Milwaukee the problem of sprinkling demand had been solved by the stagger system of permitting sprinkling on alternate days for the two sides of the street with no sprinkling permitted between 5 and 8 p.m. on any day.

FRANK C. AMSBARY, Vice Pres. and Mgr., Ill. Water Service Co., Champaign, Ill., who is chairman of A.W.W.A.'s Committee on Air-Conditioning, pointed out that the committee had developed a model ordinance governing water use for air-cooling, but that water utility managers had not done very much about putting such an ordinance into use in their communities.

Seasonal Water Demands in Vacational Areas

Was the subject of a Panel Discussion presided over by S. KEITH KELLER, Gen. Supt., Pinellas County Water System, Clearwater, Fla., who presented figures indicative of the seasonal increase in water demand amounting to 25% for the majority of Florida communities but running up to 49% for Daytona Beach in the period June, July and August.

MAURICE BRUNSTEIN, Supt. at Atlantic City, N.J., reported a variation of 4.5 to 28 mgd as the Atlantic City demand, the average being 16 mgd. Studies had revealed that elevated storage would reduce the necessity for pump throttling and save $1,600 yearly in power wasted through throttling during off season operation.

HOWARD T. CRITCHLOW, Chief Engr., Div. of Water Supply, N. J. Dept. of Conservation, Trenton, N.J., reported that N. J. seaside resorts on the average experienced summer demands of 66 per cent above the yearly average. And ALFRED FLETCHER, Director of Sanitation, N. J. State Dept. of Health, added that the disturbing fact was that these resorts are practically all drawing more than the safe yields of their wells during the summer season.

In discussing the need for more exact information on the "Requirements of Various Types of Water Users" which is the subject of committee study. L. S. FINCH, Chief Engr., Indianapolis Water Co., pointed out the value of such information in predicting the reasonable income to be expected from main extensions and therefore the proper financing to apply to such extensions, now done more by "guestimating" than anything else.

Civilian Defense

"CIVILIAN DEFENSE" by John S. Longwell, Cons. Engr., Piedmont, Calif.

Mr. Longwell pointed out at the panel discussion held on Friday morning during the general session on "Water Works and the Defense Program," that water works must have

R. J. Faust
Exec. Asst. Secy.
AWWA
New York City

M. P. Hatcher
Director
Water Dept.
Kansas City, Mo.

Also Programmers

S. K. Keller
Gen. Supt.
Pinellos Co. Wat.
Clearwater, Fla.

M. Brunstein
Supt. & Engr.
Water Dept.
Atlantic City, N.J.

materials to prepare for civilian defense. He expressed himself firmly in the belief that water works men should handle water works problems in civilian defense. As a prelude to his presentation to the results of a questionnaire survey, Mr. Longwell reviewed the Civilian Defense Organization in California as it is set up to tie in with the national, state and local organizations.

Questionnaires were sent to all state sanitary engineers. The results of the questionnaires indicate that all states have a Civilian Defense Director, and in 39 states the Chief Sanitary Engineer is a part of the State Civilian Defense Organization. Twenty nine of these are in charge of environmental sanitation in civilian defense, 7 are state water coordinators, and 3 serve on the Civilian Defense Advisory Board.

In 20 states a water works executive is a part of the civilian defense organization; in 20 states also, a mutual aid program is set up; in 18 states, the legislature is considering the possibility of loaning public property for mutual aid or civilian defense. In only five states have there been any orders from the Civilian Defense Organization in reference to the erecting of guard fences at water supplies and facilities. In no state has there been any provision for the possibility of a need for extra chlorine.

Also appearing on the panel, EARL DEVENDORF, Director, Bureau of Environmental Sanitation for the State of New York, reviewed the organization in his state where he is State Water Coordinator, by law. This law which established mutual aid in New York during the war was kept on the books and Mutual Aid has been a continuing entity, hence it was easy to adapt to the new civilian defense program. New York State has five regions, and 26 zones where there are water works coordinators. Dry runs will be made this summer in several of the zones, to determine if the organization is properly set up and staffed. First attention is being directed, of course, to target areas of which there are several in the state. Mr. Devendorf explained how civilian defense would work in N.Y. State if a target area were hit. Tests in the Syracuse area have shown weaknesses that will be remedied, and further tests are expected in other areas.

N. S. BUBBIS, Gen. Mgr., Greater Winnipeg Water District, Winnipeg, Man. spoke about the Canadian plans for Civilian Defense. In Canada, the organization of Civilian Defense is still being developed at the Federal level. It will be expanded to the provinces and the cities in the near future.

More Programmers

H. T. Critchlow
Director
Dept. Consv.
N.J. Div. Wat. Pol.
Trenton, N.J.

A. H. Fletcher
Director
Dept. Env. Sanit.
St. H'lth Dept.
Trenton, N.J.

N. S. Bubbis
Gen. Mgr.
Water Dist.
Winnipeg, Man.

Earl Devendorf
Director
Bur. Env. Sanit.
St. H'lth Dept.
Albany, N.Y.

Radio

"RADIO AS AN EMERGENCY AID" by Morrison B. Cunningham, Supt. & Engr., Oklahoma City Water Dept., Oklahoma City, Okla.

Mr. Cunningham, who has authored an excellent article on the subject of the use of equipment for determining radioactivity in water supplies (See *Water & Sewage Works*, p. 95, March 1951) has also been a pioneer in the use of radio equipment in water works utilities.

On the subject of radio, Mr. Cunningham said that the cost will depend on the type of equipment installed; it may run from $2000 to $3000, an expenditure which is not wasteful considering the benefits derived.

In the matter of radio and civilian defense, Mr. Cunningham warned that the water works should retain control of their own radio system. While he is against the civilian defense organization taking over the water works radio system, he does believe that the water utility should cooperate fully with the Civilian Defense Organization.

Mr. Cunningham pointed out that if any utility planned to buy a radio system and the appurtenant equipment, it should certainly place its order immediately because the equipment, even now, is hard to get. Mr. Cunningham gave a number of points to follow in setting up an order for radio equipment.

N. S. BUBBIS of Winnipeg, Canada, in discussing this subject recalled the flood which hit Winnipeg last winter. Although the radio system at Winnipeg had been started in 1934, it was not until the flood came that the real and ultimate worth of the system was fully realized. Winnipeg has an FM-2-way radio system, with 22 radio operated vehicles and all of them did yeoman duty during the flood.

Mr. Bubbis was emphatic in his declaration that there is no question: "a city cannot afford to be without radio in its water department."

Speaking from the floor, PAUL WEIR, Gen. Mgr., Atlanta Ga. Water Works told of the importance of radio in a water works utility. A recent main break was handled in one hr. and 15 minutes with the help of radio. A similar break before radio was available would have required three days.

M. B. CUNNINGHAM, also speaking from the floor, reported that a severe main break was handled in 46 minutes, thereby averting much property damage. Without the availability of radio, Mr. Cunningham said there would have been many thousands of dollars of damage from this particular main break.

Industry's Use of Water

"INDUSTRY'S WATER REQUIREMENTS" by Roy R. Green, Agricultural Economist, National Assn. of Manufacturers, New York City.

Mr. Green, who reported on the survey findings of a joint project of the National Association of Manufacturers and the Conservation Foundation, opened his talk by saying "Water is virtually the lifeblood of agriculture, industry, and all human existence" and "Industry is a heavy user, rather than a principal guardian, of the nation's water resources. Thus the manner in which industry utilizes water must have an important bearing on the national problem of water conservation and what may become a national development and use policy."

The data presented were summarized from the answers to a questionnaire mailed to 15,000 manufacturing concerns. More than 3,300 companies answered the questions.

The total water consumption in the U.S. is estimated to be 100 to 150 billion gallons per day, of which industry may use from 10 to 25 bil. gal. per day or at a maximum, not more than one-fourth of the total.

It is evident that the large users of water are concentrated in three types of industry, for only in the electrical, paper and pulp, and petroleum

industries are there significant numbers of plants which use 10 mgd. or more. Other relative heavy users, in the 1 to 10 mgd. class include textiles, autos and aircraft, chemicals and drugs, foods, and metals. Forty-eight plants use more than 50 mgd.

Generally, the large water users are themselves large or extensive types of manufacturing operations.

Water quality is of foremost importance in industries such as chemicals, textiles, and plastics. Facilities for treating water are more common in large plants than in small ones. About 80 per cent of the large plants have water treating facilities, and about 30 per cent of the small plants have treatment facilities.

On the subject of waste treatment, the survey indicated that approximately half of the large plants treat their industrial wastes, but only 20 per cent of the small plants have any waste treatment facilities at all.

On the matter of industrial plant expansion and availability of water for such expansion, nearly 40 per cent of the plants indicated that they did not know whether or not the water supply of their area was being used at full capacity.

Furthermore, for the most part, industrialists have little knowledge of water conservation projects, in their regions.

Characteristics of Water Use

"Characteristics of Water Use in the United States" by William F. Guyton, Cons. Ground Water Hydrologist, Austin, Tex.

Mr. Guyton, who was formerly with the USGS said there is danger of overselling conservation of a certain kind. Water supplies generally are not dwindling, but water use is growing, and the demand is exceeding the ability of development of source.

To point up these statements, Mr. Guyton quoted from data of the USGS showing the increase in water demand in the last 50 years, and the amounts of ground water used in irrigation, (18 bgd.), industry (6 bgd.), municipal (4 bgd.).

Mr. Guyton believes that there are several ways in which to distribute water use or demands. These include the matter of pollution abatement. This is probably largely a matter of economics.

While there are shortages in some places, there are many localities where development can be increased. There are three possible approaches to conservation—use less water, don't use any more than is used now, and use water that is now wasted. After all, we can't save water by not using it, and much of our water now runs off unused.

In this matter of water conservation and use, Mr. Guyton believes that legal control and government aid are necessary but are dangerous.

Family Income and Water Use

"Family Income and Residential Water Consumption" by Herbert E. Hudson, Chief Engineer, Ill. State Water Survey Div., Urbana, Ill., and Bernt O. Larson, Assoc. Prof., College of Engineering, University of Illinois, Urbana, Ill.

The paper was presented by Prof. Larson, who said that the gross water consumption in Illinois is 186 gcd. Without the City of Chicago, that figure drops to 88 gcd. In this study, some of the data developed indicated that in 15 communities water use in various categories varied widely. For example:

Residential	21.2	to 52.3	gcd.
Industrial	0	to 126.3	"
Commercial	3.2	to 27.3	"
Public Use	—	to 18.5	"
Loss or Waste	6.2	to 79.0	"

The unaccounted-for or loss of water averaged 20 per cent for the several cities studied.

Delving into the matter of water use further showed that there is a definite correlation between water use and family income level. While this relation is not fixed, there does appear to be a range of volume used for each level of family income. These figures, which apply only to the residential use, are given below.

Gal./Cap./Day	Income/Year
10	less than $1000
20	$1000
30	4000
40	5200
50	7000

Water Use Fluctuation and Revenue

Short papers on the topic "Fluctuations in Water Use and Revenues" were presented by W. G. Banks, Div. Engr., Div. of Water, Dept. of Pub. Wks., Newark, N.J., Richard Bonyun, Gen. Supt. and Chief Engr., Passaic Valley Water Com., Clifton, N.J.; and Walter Boquist, Comptroller, Hackensack Water Co., Weehawken, N.J., whose paper was presented by Adolph Damiamo, Asst. Ch. Engr., Hackensack Wat. Co.

W. G. Banks of Newark, N.J., gave statistics on observations made at the time of the water conservation program, when water supplies were so depleted in late 1949-50. Whereas the consumption of water decreased by 17 per cent, the drop in revenues was only 7.1 per cent.

And More Programmers

Wm. F. Guyton
Cons. Grd. Wat.
Hydrologist
Austin, Tex.

H. E. Hudson
Ch. Engr.
Ill. St. Wat. Surv.
Urbana, Ill.

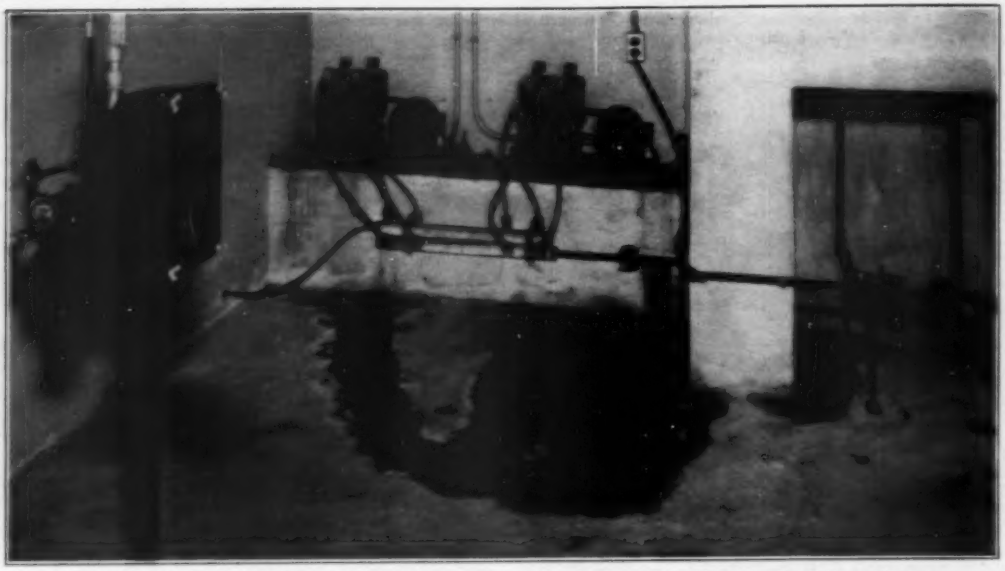
Water Revenues

W. G. Banks
Div. Engr.
Div. Water
Newark, N.J.

Rich. Bonyon
Gen. Supt. & Ch. Engr.
Passaic Val. Wat. Com.
Clifton, N.J.

R. Bonyun of Clifton, N.J., very effectively showed charts that were both readable and understandable by the audience, even in the rear of the room. These data presented information on the three categories of water in which the Passaic Valley Water Com. sells its product. These include domestic, wholesale, and industrial. Domestic water accounts for 21 per cent of the pumpage and 41.5 per cent of the income, wholesale water accounts for 24 per cent of the pumpage and 16 per cent of the income, while industrial uses account for 55 per cent of the pumpage and only 42.5 per cent of the income.

Mr. Damiano of Hackensack, N.J. gave figures for the drouth period of '49-'50. For a six months period the total water used decreased by 852 mil. gal. The revenue in that time decreased by $213,619. When requests for conservation were no longer made of the public, the consumption continued to stay down, apparently because the customers had "gotten into the habit of using less water," and the education to avoid waste had lasting effects. Water consumption in 1951, however, reached its old level, particularly with the addition of 5,000 new customers. Industrial consumption was decreased more rapidly than domestic, but when the request for conservation was discontinued, industrial consumption returned to former levels more rapidly than did residential use.



CALGON TREATMENT STATION—with Proportioneer's Chemical feed pumps and stainless steel solution tanks.

Corrosion Control at New Haven, Conn.

A story of seven years of "Calgon" treatment vs. lime treatment by the New Haven Water Company.

by MARSHALL WELLINGTON, *Sanitary Engineer, New Haven Water Co., New Haven, Conn.*

AT the end of the 1930's and at the start of the 1940's the New Haven Water Co. was having many complaints of high colored water. Laboratory examination of samples of water from the distribution system showed that the average iron content was approximately 1 ppm. This indicated that we should do something to alleviate this trouble, if possible.

1941 Demonstration

Mr. Eric Mood, in 1941, ran a pilot plant experiment on one of our water supplies and found that it could be successfully treated with "Calgon"* to reduce the iron content in the water. With the results from this pilot plant operation as a guide, we decided that we would go into full scale operation and use Calgon on one of our supplies.

*Trade name for a processed Sodium Hexameta-Phosphate marketed by Calgon Inc. of Pittsburgh, Pa.

The supply that we chose is a pumped supply. The end of the distribution system is about five miles from the pump house. A steel standpipe rides on the line about half a mile from the pump house. The mains on the end of a system were old and in very poor shape. The water being pumped has a pH of 6.8 to 7.0 and is a very soft water. The pump operated about four hours a day at approximately 1.5 mgd rate, the total pumpage being about 300,000 gpd. The Calgon solution was pumped from a crock into the suction of the pump when the pump was in operation by means of a Wallace & Tiernan Co. Hypochlorinator.

A Successful Start

The Calgon dosage was started at 4 ppm and maintained at this rate until metaphosphate was found at the end of the system. The dosage was then reduced to 2 ppm, at which figure it is still being held.

Before the addition of Calgon this system had to be blown off constantly all summer long to obtain water that was satisfactory to the consumer. At the present time this system is blown off only in the Spring and in the Fall to remove the organic matter which accumulates from an unfiltered supply. This reduction in blowing off lowered the pumpage about 33 per cent. This lower cost of pumpage and the reduced hours of labor for blowing off more than pays for the cost of the equipment and the Calgon.

On the end of this system was an old four inch main about a thousand feet long which before the starting of the treatment with the hexameta phosphate had to be blown off once a week and the water that came from it at the time of blowing off was black, indicative of sulphide of iron. As the meta-phosphate reached out into this piece of pipe the material in the blow-off water became green, then red, then white; and, finally, cleared up so that we had no more trouble from this length of pipe. Due to a higher demand on this length of pipe it was necessary to clean it to bring it back to capacity. After it was cleaned the Calgon in the water prevented the formation of red water and kept the iron content of this water below 0.3 ppm. This treatment has been going on for about seven years

and we have had no trouble with this system from colored water due to iron picked up from the pipe.

Treatment Extended

The next supply that we treated is a gravity supply with flows varying from 100,000 to 3,000,000 gallons per day. The pipes on the end of this distribution system are about 15 miles from the source. Two standpipes ride on this system about two miles from the source. The water has an average pH of 6.7 with an average alkalinity of 10 ppm or less. The variable rate of flow brought up the question as to the desirability of automatic control of the feeding of the Calgon. It was finally decided to try a manual control with the Calgon feed set at a given rate for the average flow. Here again the starting dose was 4 ppm, but after a few months it was reduced to 2 ppm. The pipes on the end of this system had been reconditioned by mechanical cleaning and were not well protected, therefore, the water was always high in color and complaints were very numerous. At the rate that we are adding Calgon it took about two years for meta-phosphate to show up in this part of the system and to clean it up. Here again the brown color in the water became whitish before the final clean-up. We now have very few complaints from this section and they are from dead ends, where there is no circulation.

A Third Supply Treated

Another one of our supplies consists of a water which at times has a pH of 5.3 with a very low alkalinity and hardness. The water going to the customers had a very high iron content and a color, both of which caused many strenuous complaints. Originally lime treatment was used in an attempt to overcome this trouble, but without much success in spite of carrying a pH of 9.1 at the end of the system.

Here again Calgon was added to the water at a dosage of 4 ppm at the start and was reduced to 2 ppm when meta-phosphate was found at the end of the system. At the start of the treatment with Calgon the question arose as to whether to stop the lime gradually or all at once. We decided to stop the lime completely on the addition of Calgon, and blow off the system if there was any sign of tubercules sloughing off. Fortunately enough we had no trouble from this cause. As this distribution system is small and the ends of the pipe are not much more than 2 miles from the point where Calgon was added it took only about two months before meta-phosphate was found at the ends of the system.

This is a gravity supply with flows of 100,000 to 3,000,000 gallons per day. With the lime treatment we needed automatic control, which control was easily adapted to the Calgon treatment. A Builder's "Chronoflo," actuated by the differentials of a Venturi tube, starts and stops an electric driven solution pump which pumps the Calgon solution into the main.

And Finally All Seven Supplies "Calgonized"

The colored water complaints from the three treated supplies having disappeared, two more small gravity supplies and a small pump supply were treated with Calgon. By small supplies I mean those where the flow was not over 3,000,000 gallons per day.

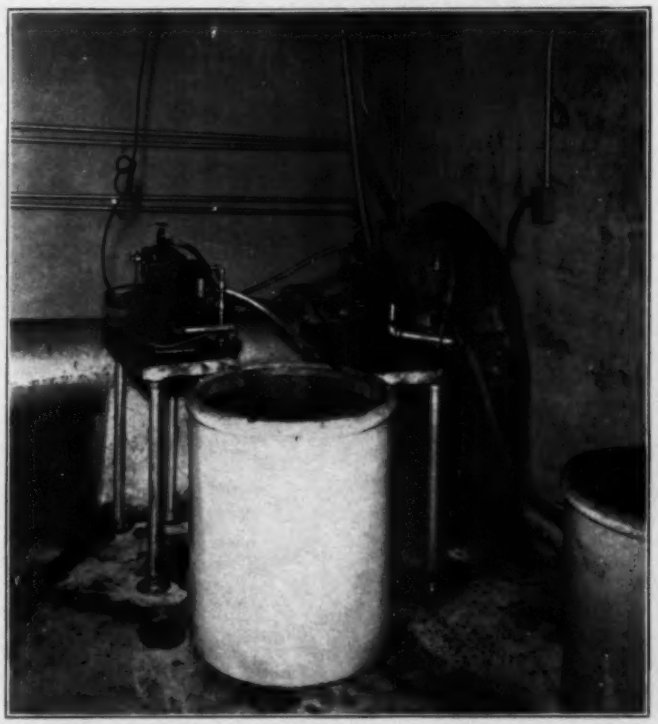
The results from these six supplies were so satisfactory that it was decided to treat another one of our supplies having the same chemical and physical qualities, but with flows varying from one to eleven million gallons per day.

The proportional feeding of the Calgon solution was carried out by means of a "Chronoflo," relay switch, solenoid water valve, stainless steel ball check and two "Proportioneer" chemical pumps.

The above equipment functions as follows: When the Chronoflo makes the electrical contact the relay switch is actuated which closes the solenoid valve on the water suction line which joins the Calgon solution line. When the solenoid valve closes Calgon solution is pumped. When the solenoid valve is open the water pressure is sufficient to close the ball check and only water is pumped. The ball check prohibits the water from flowing back into the Calgon solution. To alter the Calgon dosage the rate of solution feed pump delivery is changed manually.

Solution and Feeding Facilities

The mixing and storage tanks for the Calgon solution are two stainless steel tanks approximately 4 x 4 x 7 feet, with hopper bottoms. A stainless steel basket a foot deep sets in the top of the tanks. Calgon is added to



CALGON TREATMENT STATION—with Wallace & Tiernan chemical feed pumps. Stainless steel basket in chemical solution crock is the Calgon dissolving basket.
(Wet area on floor in both stations is not caused by leakage, but by condensation dripping from pipes.)

the basket. The tank is filled with water and allowed to stand until all the Calgon is dissolved. The basket is then removed and the solution agitated a few minutes with a wooden paddle to eliminate any stratification of the solution. A stainless steel strainer is over the outlet of the tanks to keep any foreign material from entering the outlet pipe from the tanks.

The tanks (not visible in the accompanying picture) are connected to the suction of the chemical feed pumps with hard rubber pipes and valves. The pipes and valves are so arranged that either tank can be used independently of the other. This allows one tank to be cleaned while the other is in use.

The remaining supplies on which we use Calgon have the simplest equipment possible: the chemical solution pump, an earthenware crock for the solution and a stainless steel basket to hold the Calgon while it is dissolving.

Some Pertinent Facts

I have discussed the various means that we use for the application of Calgon at New Haven. I will now discuss some of the pertinent facts in regard to this type of treatment.

The materials that have been found satisfactory for the handling of Calgon are rubber hose, hard rubber pipes or rubber lined and fittings, plastic pipe or tubing, stainless steel No. 316 and earthenware crocks.

The Calgon solution is made up as already described, and is stirred with a wooden paddle to produce a uniform solution from top to bottom.

The treatment of varying flows of water is not critical as it has been found that a ratio of one to three between low flows of water and high flows of water can be successfully treated by adding Calgon at a rate to meet the needs of the *average* low. That is to say, the dosage of hexametaphosphate varies up and down with few changes, but averages 2 ppm.

The result of Calgon treatment on the mains depends on two main factors, namely—time lapse before the water reaches a given point in the main and the dose of Calgon. In starting treatment of a supply Calgon may properly be used at a rate of 10 ppm, while opening hydrants or blow offs on the end of the system until meta-phosphate is found in the water. The Calgon dosage can then be reduced to 2 or 3 ppm and the hydrants and blow-offs closed.

The other method is to start with a dose of about 4 ppm of Calgon in the normal flow of water and when metaphosphate is found in the entire system reduce the feed of Calgon to the desired amount, which is about 2 ppm. Using this last method it took two and a half years to bring Calgon to the end of one system which is 17 miles from the point of treatment.

Blowing off a supply at the beginning of Calgon treatment depends on local conditions: All that can be suggested is if the water gets excessively dirty blow-off. In our case normal blowing-off took care of most of our troubles.

If "break-point" chlorination is used the pH of the water may be reduced to such an amount that it becomes corrosive. In this case Calgon treatment will eliminate any troubles with corrosion.

On the supplies where we are using this treatment the iron content of the water is now less than 0.3 ppm at all times.

Calgon treatment having been operative for a year or more it is possible to stop the treatment for two or three weeks before the iron content of the water in the mains starts to increase.

The most important thing to remember in this type of treatment is that water bearing Calgon must be kept flowing through the zone of protection. Dead ends and hydrant branches will not be protected by this treatment as the "Calgonized" water is not being drawn into them constantly.

Savannah Gets Carload of New Sewer Cleaning Equipment

When a city orders sewer cleaning equipment in *any* quantity, that's good news, because it means better maintained, cleaner, and more efficient sewers, fewer flooded cellars, fewer odor complaints, and better public relations.

Now, when a city purchases a whole carload of modern sewer cleaning machines, that's *exceptional* news. Savannah, Ga., did just that; and received at one time what probably represents the largest single shipment of sewer cleaning equipment ever made to one city.

The accompanying photograph shows Savannah's battery of 6 new bucket-type power-driven sewer cleaning machines; two flexible steel cleaning rods with power-drive units; one "Seweroder" automatic sewer rodding machine, which appears on the left in the photograph.

Operation and maintenance of Savannah's sewers is under the supervision of Mr. Henry Jenkins, Supt. of Sewer Construction and Maintenance in the City Engineering Dept. This record-establishing shipment was made by Flexible Sewer Rod Equipment Co. of Los Angeles.

PQ'S NEWEST research laboratories at Prima, near Phila.

120th Anniversary for Philadelphia Quartz

THE Philadelphia Quartz Co. is now celebrating 120 years of continuous business. It was July 21, 1831 when Joseph Elkinton first opened the doors of his soap and candle enterprise in Philadelphia.

The business grew, and by the time the founder's sons, Joseph S. and Thomas, finished their schooling, they took an active interest in the enterprise.

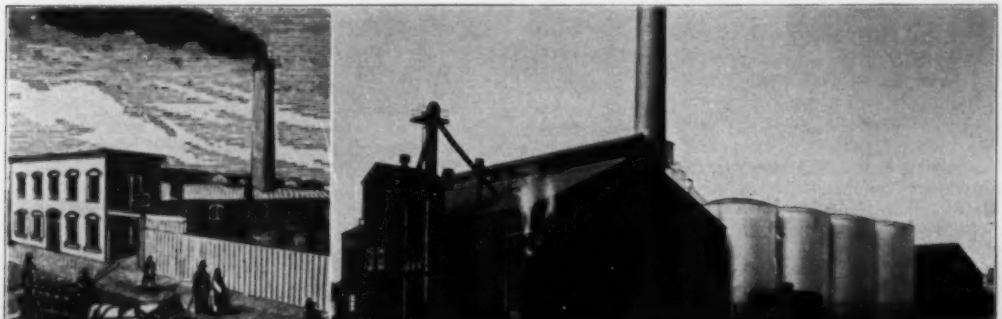
Thomas Elkinton's leaning toward technology directed his attention to a chemical, silicate of soda, mentioned in a scientific journal, and early in 1858 experiments on the product were begun. Silicate of soda in the Elkinton soaps showed a distinct advantage for increasing washing action. Silicate sales to other soap makers were inconspicuous until the war between the states brought an embargo on southern rosin to the north and interest developed in silicate as a substitute for rosin.

Increased acceptance of silicate as a soap-making ingredient required greater production. In 1864 a large factory was built at 9th & Mifflin Streets, Philadelphia, and the present firm name came into use. In 1889, business growth justified expansion to the West, with a silicate factory in Anderson, Ind. At the beginning of the present century, the acceptance of the corrugated paper box as a shipping container resulted in utilizing another of silicate's properties—adhesiveness, which had been discovered earlier. A new plant opened in Chester, Pa. was devoted exclusively to manufacturing silicates of soda. At that time, the Philadelphia factory was closed and soap making discontinued.

Through the company's research over a long period of years, series of chemicals were produced by varying the proportions of the ingredients of silicate of soda which led to a variety of useful applications. The list of industries now using silicate of soda is long, and includes, of course, prevention of corrosion in hot and cold water lines and coagulating aids for raw water supplies and waste waters.

Today plants are located in eleven cities in the United States and Canada. Thomas W. Elkinton, great-grandson of the founder, is President of the Eastern and Canadian companies, and a director of the California company. The present directors of Philadelphia Quartz Company are J. P. Elkinton, J. G. Vail, T. W. Elkinton, W. Martin, J. A. Norton, C. L. Baker, A. W. Elkinton, E. A. Russell, J. C. Russell.

General offices are situated in the Public Ledger Bldg., Independence Square, Philadelphia.



1831 ——————————————— and 120 YEARS AFTER—PQ's first "silicate factory" and one of today's silicate plants.

M.C.A.'s 5th Conference on Pollution Abatement

Productive of Useful Exchange of Information and Pubic Relations Patterns

THAT this report has had to be delayed is regretted. The 5th Conference on Pollution Abatement held by the Manufacturing Chemists' Association in New York City, April 16 and 17, was the best attended of any of the five conferences. It was the subject of an editorial in our May issue, in which attention was drawn to the fact that pollution abatement is becoming "big-business," as evidenced by the known expenditures for revamping processes and constructing waste treatment plants within the year.

Chairman Cox Reviews Objectives of Pollution Committee

The conference was opened by LYMAN COX of the Du Pont Co. in his capacity of Chairman of M.C.A.'s Pollution Abatement Committee. For the benefit of newcomers and guests, Mr. Cox stated the following as amongst the objectives of the Committee.

(1) The exchange of technical and regulatory information and "know-how" in alleviating stream pollution and aerial pollution.

(2) The publication of manuals on pollution abatement procedures and practices.

(3) Focussing attention on the importance of water to industry.

(4) Evaluation of pollution and pollution abatement as it affects public relations.

(5) Advancement of uniformity in pollution abatement laws in the several states and the workability of such laws and regulations developed by state agencies.

(6) Assembly of available information on methods of waste treatment and distribution of such information to M.C.A. members.

The first and sixth objectives are the underlying reason for the existence of M.C.A.'s Pollution Abatement Committee; and, a highly important objective, since it has been decreed by those high up in the chemical industry that stream pollution abatement and waste treatment is not to be allowed to fall into the category of competitive enterprise. This decision opened the door for the establishment of pollution abatement committees and conferences for the free exchange of information and "know-how" within the chemical industry.

Second in importance amongst the objectives is, to this writer's thinking at least, that objective which calls for advancement of uniformity of state laws and regulations pertaining to pollution control and in the improvement of workability of such laws and regulations. If industry is to be accorded a fair-deal in pollution abatement what can legitimately be required on one bank of a stream should certainly suffice for a similar plant on the opposite bank where the stream flows between two states. One certain path to Federal control is to have it otherwise.

So much for editorializing; now back to reporting.

Chairman
Lyman Cox
Ind. Wastes Engr.
E. I. du Pont Co.
Wilmington, Del.

Presider
B. W. Dickerson
Sanitary Engr.
Hercules Powder Co.
Wilmington, Del.

Legal and Regulatory Aspects Discussed

Under leadership of Du Pont's W. G. REYNOLDS, as Chairman of M.C.A.'s Legal Advisory Committee, a panel of speakers reviewed the legal and regulatory aspects of pollution control, and water control in general, at the Federal level and in various states and sections of the country.

Mr. Reynolds pointed to the need for more uniform legislation in pollution control by the several states and stated that the Council of State Governors had adopted a resolution favoring such. He commented that the so-called "Model Act" drawn up by the U. S. Public Health Service engineers and legal advisors although not wholly acceptable to the M.C.A. Committee was considered a very worthwhile start and in general, good.

Then Mr. Reynolds and T. S. O'Brien (Air Reduction Co.); Chas. Maddock (Hercules Powder Co.), and Chas. E. Caspari, Jr. (Monsanto Chem. Co.), in turn reviewed developments and proposals in the way of pollution control legislation and regulation throughout the nation.

In particular the acts of West Virginia and Utah were considered to be thorough but fair and workable. These acts call for the issuance of Pollution Permits which are mandatory. Fines and jail sentences are the penalties for those who persist in willful violations. Stream classification can not precede hearings on the proposed classification and the same requirement applies when and if "Standards for Effluent Quality" are to be set up at some future date.

The bill being proposed for North Carolina is based on the "principle of reasonableness," according to Mr. Maddox of the Committee. It avoids the necessity of industry's disclosure of secret processes or formulae. All orders issued by the Commission on an industrialist must first be tested as to practicality, economic soundness and possible effects upon the community.

Cleary Dinner Speaker

The dinner speaker was EDWARD J. CLEARY, Exec. Director and Chief Engr. of the Ohio River Valley Sanitation Commission, who came to the conference in spirit bordering on the exuberant. The cause for such was the fact that his agency and its functioning had stood the test of constitutionality. Still fresh news at the time, Mr. Cleary announced that the U. S. Supreme Court had reversed the West Virginia courts, which had held that West Virginia's participation in the Ohio River Compact was unconstitutional. The state court's decision, of course, constituted a severe threat to the entire undertaking. The decision was a distinct and highly reassuring victory in the interest of stream pollution abatement through the establishment and functioning of interstate compacts. Those attending the conference seemed to be almost as happy over the outcome of this important test case as was Mr. Cleary. As stated in our May editorial, the decision gives prominence and strength to pollution abatement progress in general.

Mr. Cleary spoke, then, on the importance of water quality to industry and consequently the stake of industry in pollution abatement for water quality's sake. More and more it is being realized that economic health, if not actually survival, is to depend

upon water conservation. Concerning interstate streams he felt that interstate water control compacts must be made to work if Federal control was to be avoided, and strongly advocated greater uniformity in state water control legislation, whether in connection with compacts or states functioning individually.

Mr. Cleary then reviewed progress made to date by the Ohio River Sanitation Commission which was 17 years in the process of being developed as an 8-state compact operating on a $100,000 budget, which became a reality in June 1948. He stressed the harmonious and successful functioning of Industry Action Committees working in cooperation with the Commission for the past two years. Also, the fruitful results from cooperative research projects participated in by industry, purveyors of chemicals and equipment, State and Federal health authorities. The largest, just completed after two years of study, had been the studies to develop methods for the destruction or elimination of phenols from wastes generated in by-product coke production. Water quality standards had been developed for portions of the Ohio River and tributaries and degrees of sewage and waste treatment set to insure maintenance of the stream standards established. Another set of studies had been those to establish the toxicity of a variety of substances in water.

Mr. Cleary, while admitting that River Basin Compacts could be considered an experiment in government, in the last analysis, stream regulation and water quality control is nothing short of an economic undertaking in the interest of the greatest numbers having a stake in water conservation and water quality control in the future.

A New Catalytic Oxidation Process Announced

"Destructive Catalytic Oxidation of Aqueous Waste Materials" was the title of a paper by Dr. D. V. Moses and Ralph V. Green, Technical Supt. and Asst. Tech. Supt. of the Polychemicals Dept., E. I. du Pont de Nemours & Co., Belle, W. Va.

This paper disclosed for the first time a new method of rapid chemical oxidation of certain organic compounds which leave the Belle, W. Va. plant, in aqueous solution to create pollution. In the process a catalyst is employed and of the catalytic materials tried copper chromite has been the overall most practical and economical. In the Belle situation the oxidation process is applied to the vapor phase of the volatile organics leaving the stills. In this instance the condensed vapors contain 3.5% organics —mainly formaldehyde with methanol and formic acid in various amounts. In a second case the process was successful on vapors composed of 92% water and 8% organics in the form of ethylene glycol derivatives. The vapors and air are preheated separately and run together over the catalyst. To control the temperature by dilution of the vapors, steam at 10 psi. is admitted to the system automatically ahead of the catalyst—copper chromite. All pilot scale work has been completed and a full scale plant is in process of installation.

Messrs. Moses and Green presented data to show that biological oxidation or burning out the organics in the vapor phase with natural gas proved impractical or too costly. These findings led to the development of the direct catlytic oxidation which yields the maximum economy of operation on vapors containing 2.5% organics and converter temperatures above 300°C. but under 600 degrees. The process has proved practical on vapors containing up to 8% organics at higher operating costs. It was the opinion of the inventors that catalytic oxidation can be applied to aqueous solutions as well as to the vapors leaving the still columns.

Dinner Speaker
Edw. J. Cleary
Exec. Dir. & Chief Engr.
Ohio River San. Comm.
Cincinnati, O.

Moses and Green concede that the process may not compete economically with direct gas burning of the vapors in combustion chambers, maintained at 700°C. or higher, when the concentration of organics in the vapor phase are in excess of 5%. However, it must be pointed out that such comparison is based on the Kanawha Valley price of gas at 35c per 1,000 cu. ft. and exhaust steam at 30c per 1,000 pounds.

Chemical Oxidation of Organic Polutants

"Oxidation of Organics by Chemical Means" was discussed by Harry A. Faber, Research Chemist of the Chlorine Institute Inc., N.Y. City, who told of the recent development of a process of employing oxygen rather than air in a process similar to the activated sludge process in a plant about ¼th the size of a standard activated sludge plant. The process seemed to have other advantages such as denser sludge and greater controllability.

He then recounted the recent experiences with ozone, chlorine and chlorine dioxide for the destruction of phenols in by product coke plant waste liquors. These were the same studies mentioned by Mr. Cleary earlier in the meeting as cooperative studies sponsored and supervised by the Ohio River Sanitation Commission. The chlorine requirement was high (3000 to 4000 ppm.) but effective. Lesser dosages of chlorine dioxide were found effective and productive of no taste producing by-product such as the chlor-phenols. Combinations of chlorine and chlorine dioxide were also effective and without chlor-phenol productions. Ozone produced excellent results also and the selection of the chemical combination would be determined on an overall cost basis.

The destruction of cyanides with chlorine in an alkaline medium had become an established means of destroying these toxic compounds in electroplating wastes. In a pH zone of 8.5 to 10 each part of cyanide (CN) destroyed required 2.7 parts of chlorine and 3.8 parts of caustic soda.

A. E. Griffin of Wallace & Tiernan Co., who had direct contact with the phenol waste studies, explained the very high chlorine dosages were required to satisfy the chlorine demand of the liquor, exerted by the ammonia and sulfur compounds, before there would be any attack on the phenols. A rubber processing plant waste containing phenols had been successfully treated with 2000 parts of chlorine for phenol destruction.

Determination of Toxicity Levels

"Methods for Determining Toxic Levels of Industrial Wastes in Streams" were briefly described by Prof. Chas. E. Renn of Johns Hopkins Univ. in an extremely interesting talk in which he pointed out that biotests with living organisms would generally yield more information than chemical tests. For this purpose bottom organisms and daphnia were the overall most satisfactory test animals. Then he discussed the use of aquaria receiving various ratios of waste to water input and the copper float anchored within the stream receiving the

D. V. Moses
Technical Supt.
E. I. du Pont Co.
Belle, W. Va.

Dr. Chas. E. Renn
Professor
Johns Hopkins Univ.
Baltimore, Md.

wastes. He set forth the advantages and disadvantages of each method, the equipment and care involved in conducting such tests. We regret our inability to do justice to the talk by Dr. Renn and only those who have heard his presentations will fully understand why. We can add that we know without doubt that Prof. Renn has put the methods which he described to most effective use in determining in advance the permissive stream loadings by wastes from certain plants. As Charlie Renn might put it—you may be able to fool a chemist much of the time, but you can't fool a Daphnia any of the time. The chief problem is how best to keep Mr. D. happy while he is monitoring your waste discharge and stream flow rations.

E. W. SURBER, U.S. Public Health Service, Washington, in discussing the toxicity of some chemical substances, stated that 10 gal. aquaria were used in making the tests. The best small test-fish is the Bluegill Sunfish of 2 inch length. In comparison with D.D.T. the following substances were found to be as many times as toxic.

Tetra Ethyl Pyrophosphate	125	times
Nicotine Sulfate	25	"
Rotenone	4	"
Chlordane	½	"

In reply to a question, Mr. Surber said that 15 ppm. of carbon dioxide in water will cause fish distress.

Underground Waste Disposal

"UNDERGROUND DISPOSAL OF BRINES AND OTHER AQUEOUS WASTES" was discussed by J. G. Ferris, Engr., U.S. Geol. Survey, Washington.

Mr. Ferris explained the possibilities of aqueous wastes disposal into deep injection wells put down for that explicit purpose. He said that up to several hundred gallons per minute could be so disposed of with proper operation and maintenance. He cited Ocala, Fla. and other places which have for a number of years disposed of the municipal sewage through socalled drainage wells into the cavernous limestone strata. Mr. Ferris offered U.S. Geol. Survey data to anyone contemplating this means of waste water disposal, there being available a large back-log of such data on hand. He cited the value of putting down observation wells, and studying the situation, prior to going into a full scale undertaking. He also cited the hazards to neighboring water wells which must be considered.

THOS. POWERS, Wastes Disposal Engr. for the Dorr Co. of Midland, Mich., reported that studies were now under way at Midland where $60,000 was being spent on ten 6000 ft. observation wells, the idea being to return certain waste brines to the ground. In all, $140,000 was to be spent on this experimental project.

LINN H. ENSLOW, Editor of *Water and Sewage Works* said that he could not refrain from questioning the advisability of injection of wastes in any form into the underground water strata. Already a number of well water supplies had been vitiated by industrial wastes. He said he was quite familiar with the scheme of using sewage wells in Florida and there had been cases of water supply contamination as a result. The method had been abandoned and although no known pollution of water supply had occurred from the Ocala, Fla. practice it was being discontinued, and sewage treatment is to be instituted on orders of the State Health Department. Mr. Enslow said that one of the chief considerations in this scheme of industrial waste disposal was the danger of the casing of disposal wells corroding through and vitiating water stratas all the way down. He said that once the water supply aquifer is contaminated with industrial wastes the unknown is just how long it might take to clear the pollution from the aquifer through the water supply wells before these wells could be considered useful again. The ground water supply would possibly have to be written off completely—and then "what to do for water?"

Thos. J. Powers
Sup't. Waste Disp'sl.
The Dow Chem. Co.
Midland, Mich.

Linn H. Enslow
Editor
Water & Sewage Wks.
New York, N.Y.

Mr. Ferris admitted that this constituted a real hazard and that nobody could predict the ultimate solution once the water supply aquifer was vitiated with industrial wastes.

Solution of Shenandoah Pollution at Waynesboro, Va.

"POLLUTION ABATEMENT THROUGH WASTE REDUCTION" was the interesting story of Dr. Roy McCracken, of DuPont's acetate rayon plant at Waynesboro, Va., who had been given the job of reducing pollution of the Shenondoah River.

Dr. McCracken stated that three industrial plants located in Waynesboro, Va., faced with the necessity of doing something about the pollution of the Shenondah, decided in 1947 to make a joint study of the river in cooperation with the Va. Water Control Board. Thus the responsibility for the pollution, along with costs of the studies, was allocated. The case being clear, reduction in pollution had been appreciable during the past three years, amounting to a 75% reduction in terms of population equivalent and oxygen demands.

Dr. McCracken, having the choice of constructing an expensive waste treatment plant or attempting to reduce the pollution through process changes and change in equipment, decided on the latter course. The expenditure of a half million dollars for the changes and improvements suggested by Dr. McCracken received the green-light and the net result both in river improvement through reduced losses and recovery of acetic acid and acetone, plus improved plant operating economies through instrumentation and records, have exceeded expectations.

Dr. McCracken stressed his opinion, based on experience, that pollution abatement is the job of the plant operating group, with the aid of technical advice. He contends that the education of the foremen and operators, to the point that all hands wanted to see the pollution abatement program succeed, was a primary fac-

H. A. Faber
Research Chemist
Chlorine Inst. Inc.
New York, N.Y.

A. E. Griffin
San. Engr.
Wallace & Tiernan Co.
Newark, N.J.

tor. All who took an interest can now look with pride on accomplishments—what's more, top management is happy and the state authorities are well pleased. Best of all, the Waynesboro plant has no expensive waste treatment plant to operate and maintain at added operating costs year-in and year-out.

Ed. Note: The details of accomplishments through the process and equipment changes at DuPont's Acetate Rayon plant at Waynesboro, Va. in five major steps will be covered in an article by Dr. McCracken in a future issue of this magazine.

Treating Phosphorous Plant Effluents

"THE TREATMENT OF EFFLUENTS FROM A PHOSPHOROUS PLANT" was described by M. L. Parker, Production Mgr., Oldbury Electrochemical Co., Niagara Falls, N.Y.

Mr. Parker explained the method of oxidation of metallic phosphorous in waste waters from his plant, which consists of short period sedimentation in combination with excess chlorination. The most interesting feature of the plant is the equipment, designed and installed by Oldbury personnel, which measures and records the residual (excess) chlorine in the oxidized effluent. It was thought by Mr. Parker to be the first instance in which residual chlorine was automatically monitored and recorded. An alarm sounds at any time that the chlorination fails to satisfy the chlorine demand of the plant waste and completely oxidize the phosphorous.

Air Pollution Sessions

We regret that the five papers presented on air pollution problems and their solution must go unreported, since there has never been any attempt to cover this field in *Water and Sewage Works*. However, we can not refrain from calling attention to the report by M.C.E. Hamilton of the Union Carbon and Carbide Corp., Charleston, W.Va., on the methods pursued in handling the "smog" problem in the Kanawah River Valley, in which industry joined forces in fighting a political hue and cry for blood with a scientifically sound campaign. Industry's spokesmen sold the proposed program to the public and newspaper editors and successfully blocked anti-air pollution bills in the 1949 legislature. Subsequently industry subscribed to a $27,000 study to determine the most effective measures to be applied in solving the "smog" problem in the Kanawah Valley.

"On Fluoridation"

(From Ollie Crawford's column "Headline Hopping" in *The Philadelphia Enquirer*)

"Philadelphia is the place where you can drink nothing that's stronger than the water. Now—

"*FLUORINE'S* use is proposed for our Philadelphia water. This must be the one thing that's not in it. And—

"Before they can put Fluorine in, they'll have to make room. But—

"Fluorine gives you strong teeth, and that will help you chew the water.

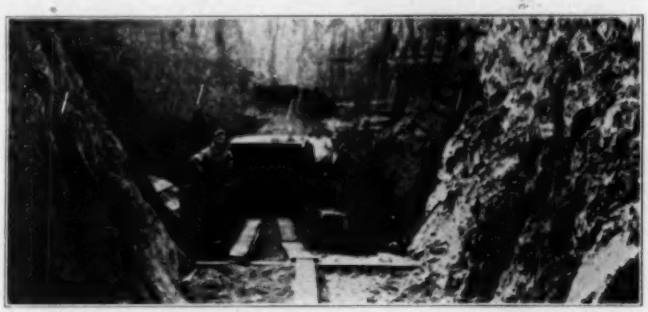
"It hasn't any taste, so you'll notice it right away. The trick is to get just enough Fluorine and not too much, as with gin.

"The Fluorine will cost $400,000 a year, and this is just a drop in the bucket. It's used in 30 cities, which is where the taxpayer's 'bark isn't worse than his bite.'

"The only dentists drilling in those towns are the ones who were drafted. They say they haven't seen a cavity since their last trip to the Grand Canyon.

"The city can introduce Fluorine to the water, but it doesn't know the names of all the other stuff that's in there.

"Philadelphia's water, you know, has made a name for itself; but, you're not allowed to say it."



Solving An Industrial Waste Problem

National Supply Co. to Treat Waste

As part of an overall stream purification program, a 145-foot tunnel is being dug from the site of a proposed sewage treatment plant at the Spang-Chalfant Division plant of The National Supply Co., Ambridge, Pa. The tunnel will carry treated sewage from the plant to the Ohio River.

The tunnel's sectional steel shell, which measures four and a half feet in diameter, will house a 36-inch reinforced concrete sewer. It is being constructed by the W. H. Schmidt Contracting Company of Ambridge.

The tunnel slopes approximately one inch per foot from the manhole after the settling basin to the river. When finished, it will have a carrying capacity of 68,000 gallons per minute.

National Rivers and Harbors Congress Suspended This Year

The annual spring meeting of the National Rivers and Harbors Congress was suspended this year, due to the international situation, but the organization's president, John L. McClellan, senior U.S. Senator from Arkansas, called a "special meeting" of officers and directors on May 11 in Washington.

Sen. McClellan's message referred to the outbreak of war in Korea last June 25, and to President Truman's declaration of a national emergency Dec. 16.

The projects committee of the rivers and harbors congress met on May 10 to consider individual water-resource projects for which the endorsement of the Congress is desired. Sponsors were not required to observe the committee's traditional rule for personal appearance, but were permitted to submit applications and supporting data by mail.

The Officers' meeting took note of the administration's view on the necessity for reduction of non-defense spending, and of the President's budget message which, by inference, recommended against starting any new projects except seven power projects specifically mentioned. Accent was laid on relationship of flood control and navigational matters to the defense effort.

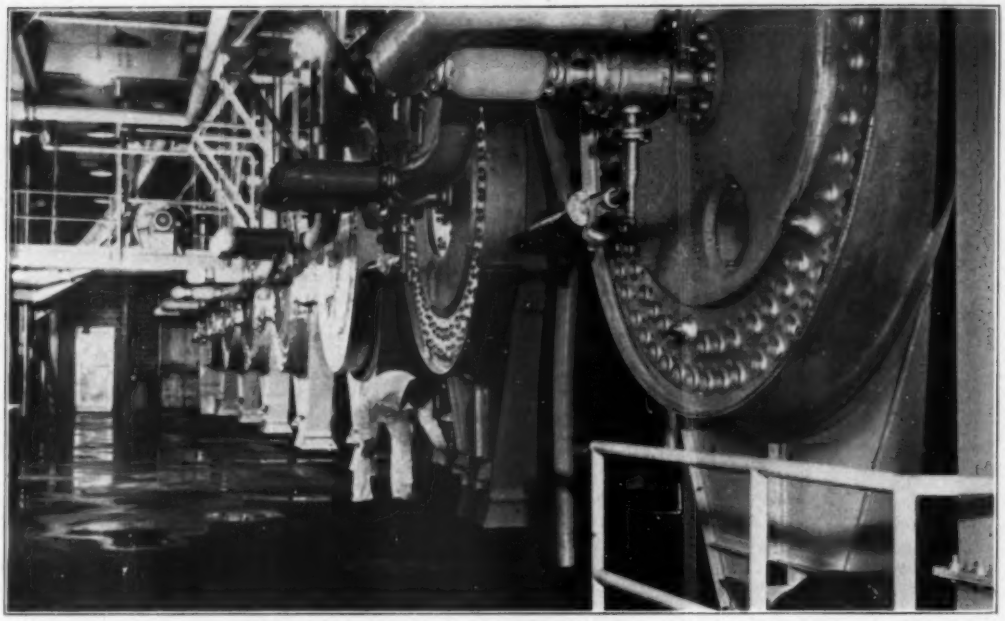


Fig. 1—Battery of rotary steam-tube dryers

Treatment of Distillery Wastes*

More properly, the elimination of such wastes through recovery of salable by-products

by C. T. CARSON, *Vice President, Hiram Walker & Sons, Ltd., Walkerville, Ont.*

IN a discussion of industrial wastes, it may seem natural to refer to the unrecovered by-products of distillery operations as "distillery waste". Today, it is no longer a correct term since it implies something for which there is no market or for which there is no economical method of recovery. Thanks to efforts of research workers and engineers, what was once a waste product of great nuisance value is now a valuable by-product that has an important place among stock and poultry feeds. The purpose of this paper is to outline the methods of recovery in general use in the distilling industry and, more specifically, to describe the functions of the waste conversion and recovery plant now in course of construction by Hiram Walker & Sons, Ltd., at Walkerville, Ontario.

Inorganic wastes are of little interest to sanitary engineers because they require no oxygen for their stabilization, except for a few minor cases such as sulphides. Government engineers are interested, however, due to the fact that inorganic wastes tend to fill up streams by sedimentation and some of them, such as cyanides and arsenic compounds, are extremely poisonous.

Organic wastes are of interest to sanitary engineers because in most cases they require oxygen for their stabilization. The oxygen demand will depend upon the nature of the organic material. Cellulose, for instance, has a very low oxygen demand; but, on the other hand, dissolved lignin, sugars, etc., from wood as extracted during the paper pulp process have a high oxygen demand. Likewise, the crude fiber found in distillery residues has a low oxygen demand whereas the soluble protein, pentoses, etc., in these residues have a high oxygen demand.

Distillery wastes, more properly called "stillage", consist of the fermentation residues discharged from the stills after the distillation has stripped the fermented mash of its alcoholic content. This stillage constitutes the only waste of any significant volume or strength from a distillery operating on cereal grains. It contains suspended and dissolved grain solids and a certain amount of organic acids developed during fermentation. In volume, it will run from 30 to 40 gallons per bushel of grain ground. It possesses a biochemical oxygen demand (B.O.D.) of 15,000 to 25,000 parts per million (ppm.).

Disposal Methods

In the long history of the distilling industry, the disposal of stillage has

*This paper, presented before the Canadian Institute of Sewage and Sanitation, is here printed by permission.

presented an acute problem and various solutions have been adopted in which the return to the distiller has been anything from a total loss to a quite profitable operation. Frequently it has been possible to have farmers haul it away in barrels or tank trucks, although many plants are not so located as to make this an attractive plan for the farmers. At best, it gives a return of only a few cents per barrel.

At one time, certain large distilleries undertook the feeding of cattle on a large scale at or near the distillery, using the stillage in liquid form as the grain supplement. Because of the offensive odors that develop, the practice does not tend to produce good will on the part of the neighbors.

The sanitary District of one Illinois city has thermophilically digested part of the grain and molasses waste of one distilling concern for a number of years. Broad irrigation and lagooning are used to a very limited extent. It is reported that one acre of land is needed for every 10,000 gallons per day of stillage. In one small distillery during mid-year when stillage is not taken by farmers, whole stillage is satisfactorily disposed of by this method at the rate of 5,000 to 10,000 gallons per acre per day.

Recovery

None of the above methods has much to commend it as a revenue producer and it is only by the recovery of fermentation residues as "distillers' feeds" by drying processes that what was waste has become a valuable by-product. In the production of such feeds, the whole stillage is passed over screens to remove the larger particles. When dried, this coarse material is termed "distillers' light grains." The water-soluble material and finer suspended particles pass through the screen and it is this "screened stillage" that has presented the most acute disposal problem. When it could not be disposed of by one of the methods already described, it was common practice for many years to run it into streams or even to a municipal sewer. In the latter case, it would be diluted with large volumes of water or even neutralized with lime to reduce corrosion. In view of its acidity, approximately 0.5% as lactic acid, and a pH of 4.0 or less, the need for such treatment is apparent.

To overcome the disposal problem, there has been an increasing adoption of total recovery of fermentation residues in recent years. The early reports of those who pioneered in this attempt were not encouraging; there was little to no profit and often financial loss. The plant and equipment were very costly, and the market uncertain.

The Hiram Walker Research Laboratories, along with others vitally interested in the problem, have been carrying on engineering and process research for many years and the results of these efforts, along with an increasingly active market for distillers' feeds, have changed a losing proposition to one of reasonable profit. Distillers' feeds may be classified under three general types:

a. Light grains, produced by the drying of the coarser particles from the screen.
b. Dark grains, a combination of light grains with the syrup derived from the evaporation of the screened stillage, the mixture being finally re-dried.
c. Dried solubles, produced by the drying of the syrup by itself.

Table 1 gives typical analytical data on two types of by-product, dark grains and dried solubles.

Table 2 gives the gallonage of distillery wastes per bushel of grain introduced into the distillery process,

Table 1

TYPICAL PERCENTAGE ANALYSIS OF DISTILLERS FEEDS FROM CORN AND RYE PRESSURE-COOKED GRAINS

	Dried Dark Grains (Grains with Solubles)		Dried Solubles	
	Corn 90% Barley Malt 10%	Rye 85% Rye Malt 15%	Corn 90% Barley Malt 10%	Rye 85% Rye Malt 15%
Moisture	11	11	5	5
Protein	28	29	25	36
Fat	9	3	6	1
Fiber	7	8	1	1
Ash	6	6	9	9
Nitrogen-free extract	39	43	54	48

(a) Analyses vary within small limits because of processing variables and analysis of the cereal grains mashed.
(b) By difference.

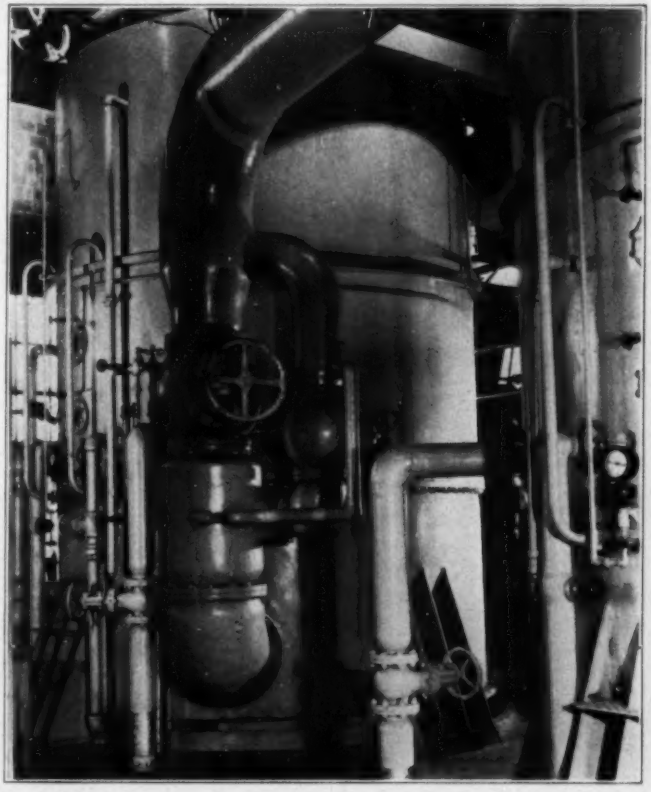


Fig. 2—Multiple-effect evaporators

Fig. 3—Battery of solid basket centrifuges

and the solids content and B. O. D., under varying degrees of recovery, depending upon the plant equipment available for that purpose.

Item A in Table 2, represents a distillery with no provision for recovery of fermentation residues. Very few distilleries operate in this way.

Item B is typical of many medium and small sized plants, producing light distillers dried grains but disposing of the screened stillage by some means such as discharging it to a stream.

Item C represents total recovery of the potential values, with wash water and cooling waters only being discharged to the sewer. This is the practice in the larger distilleries and is to be the procedure in the new Feed Recovery Plant being erected at the Walkerville Distillery.

Table 2

DISTILLERY WASTES PER BUSHEL OF GRIND

A. *No Stillage Recovery*

	Gal.	Lb. Solids	B. O. D.	Population Equivalent
Stillage	32 ±	19	25,000 ±	40 to 50
Wash Waters, etc.	Var. *	2	Var. *	2 ±
Total				42 to 52 ±

B. *With Recovery of Stillage Screenings Only*

	Gal.	Lb. Solids	B. O. D.	Population Equivalent
Residual Stillage	32 ±	10	15,000 ±	25 to 30
Wash Water, etc.	Var. *	2	Var. *	2 ±
Total				27 to 32 ±

C. *With Complete Stillage Recovery*

	Gal.	Lb. Solids	B. O. D.	Population Equivalent
Residual Stillage	0	0	0	0
Evaporator hot-well water	Var. *	Var. *	Var. *	2 ±
Wash Water, etc.	Var. *	2	Var. *	2 ±
Total				4 ±

*Varies with plant equipment.

Total Recovery Process

Stillage, as discharged from the stills and entering the recovery plant, contains from 5 to 7 per cent total solids, of which about one half is suspended. The first step in the process of recovering distillers' by-product feeds is to pass the stillage over screens, with openings of about 1 mm. There is considerable variation in the style of screen used in different distilleries but the common practice is to employ an inclined screen, equipped with chain-drag paddles that move the stillage down the screen. The screen separates the coarser material from the bulk of the watery fraction (screened stillage).

From the screens, the coarser material goes through presses where a considerable additional quantity of thin stillage is squeezed out. The presses are of a rotary type and operate continuously. They reduce the moisture in the grain to about 68 to 75 per cent and discharge to rotary steam tube dryers.

The rotary dryer (Fig. 1) is a horizontal rotating drum carried on trunnions. It usually contains two annular rows of steam tubes and lifting flights which spill the grain into a current of preheated air that, in turn, carries the

moisture out a stack to an expansion chamber. This expansion chamber is equipped with sprays that are fed with thin stillage and are designed to trap any fine grain that might otherwise escape. The washings are returned to process for total recovery of the solids. In the fabrication of the dryers and expansion chambers, those areas that would become wetted in the process are constructed of stainless steel.

The screened stillage, coming from the screens and from the presses, and containing about 0.8 per cent suspended solids and 3 to 3.5 per cent dissolved solids, is, in ordinary practice, piped to multiple-effect evaporators where it is concentrated to a syrup containing about 25 per cent solids.

Walkerville Plant

In the Walkerville plant, however, the thin stillage will be fed to 48 in. diameter, solid basket, centrifuges, (Fig. 3) where settling of fine suspended solids is effected by a centrifugal force of 500 times gravity. These machines are constructed of stainless steel and rotate at 900 rpm. The settled solids, or centrifuge cake, is fed with press cake and other fractions to the rotary dryers. The centrifuge effluent becomes the feed to the evaporators. By the removal of suspended solids in this way, the thin stillage may be concentrated to 30 to 50 per cent solids, at which concentration it becomes quite viscous.

Theoretically, chemical treatment, pressure cooking of the stillage and other treatments prior to clarification will permit even higher concentrations to be obtained through multiple-effect evaporation but none of these procedures has been accepted as economically feasible by the industry.

In the Walkerville plant, the evaporating equipment will consist of four evaporator bodies, (Fig. 2) operating in series, and one finishing pan. Each body is 8 feet in diameter and 20 feet high. Each contains a heating section, or calandria, consisting of 2 inch O.D. copper tubes rolled into copper tube sheets. The entire evaporating assembly contains 4824 tubes averaging 6 feet in length, with a total heating area of 13,250 sq. ft. This equipment layout represents a large capital investment that is only justified because of the operating economies resulting from the re-use of the steam input in successive effects.

The vacuum produced by two barometric condensers, one on the fourth effect and one on the finishing pan, makes possible the utilization of the latent heat in the steam evaporated from each effect.

Experience has shown that in the evaporation of stillage, the problem of corrosion becomes quite important. It has been general practice to use cast iron in the fabrication of the evaporator bodies and since the life expectancy of such equipment is about 10 years, it was decided that our Walkerville evaporators should be constructed of stainless-clad steel. While this adds considerably to the cost of the equipment, it is anticipated that the lower maintenance and replacement costs will justify it.

The recovery method developed in the Hiram Walker Research Department, which uses centrifuges for removal of suspended solids prior to multiple-effect exaporation, has been working satisfactorily for fifteen years. This process throws more of the drying load on multiple-effect evaporators by permitting higher concentration of solids, reduces the drying load on the rotary dryers and thus reduces steam consumption per unit of stillage recovered. This steam economy is particularly essential to Canadian stillage recovery plants, due to their high fuel costs.

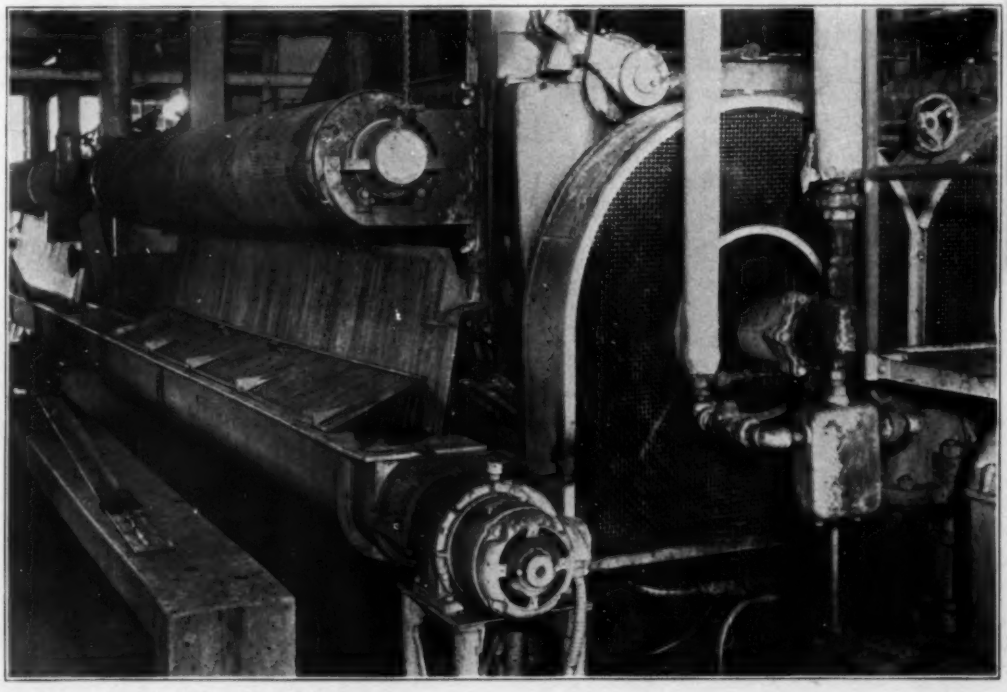


Fig. 4—Drum dryers for distillers dried solubles

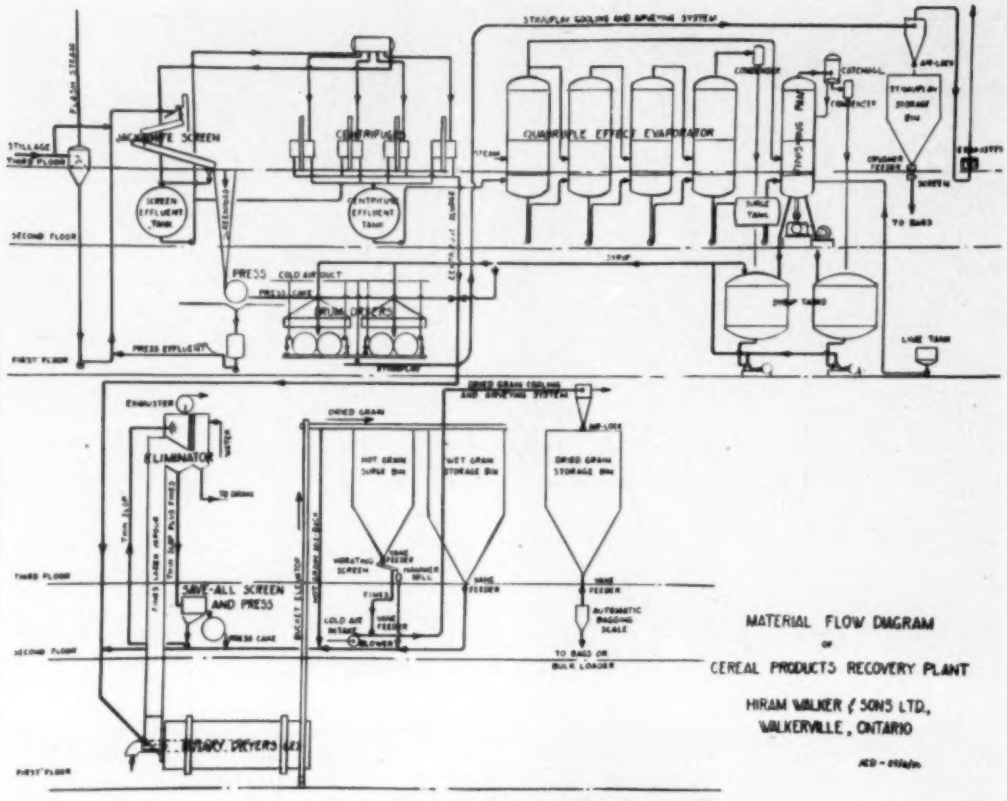


Fig. 5—Material flow diagram of cereal products recovery plant

The By-Products

The centrifuge cake, along with the concentrated solubles from the evaporators, may be readily mixed with the pressed screenings and recycled dry grains from the rotary dryers to give a uniform and readily dryable material known to the trade as "dark distillers' grains" or "distillers' grains containing solubles." Whether light grains or dark grains are produced, the final product is cooled and loaded into box cars by a blower system, or sacked burlap bags.

The syrup produced in the evaporators may be dried separately on drum dryers to give "distillers' dried solubles." This product was originated by our Research Department in 1939 as a pound-for-pound replacement for the more expensive dried milk products used in poultry and livestock rations. The method consists of feeding the evaporator syrup in a thin layer on large rotating steam-heated steel drums. (Fig. 4) The water is driven off during the rotation of the drums and the product is peeled off by doctor knives in a continuous sheet, later to be flaked on crushing rolls.

Figure 5 is a material flow diagram of the Recovery Plant now under construction at Walkerville. It incorporates all of the equipment and methods described in the preceding paragraphs on the total recovery process with the exception of the spray-process drying of evaporator syrup.

Figure 6 is a simplified flow diagram showing the relationship of the Recovery Plant to the rest of the distillery.

Equipment Used

Of the different types of stillage, that produced from an all-rye grain mash requires the largest outlay of equipment per bushel of grain processed; a mixture of grains containing approximately 70 per cent corn, 20 per cent rye and 10 per cent barley malt requires the least amount of equipment. It is obviously necessary to build a plant to take care of the most difficult conditions of operation and this principle has been followed in the planning of the Feed Recovery Plant of Hiram Walker & Sons Limited. The illustrations and the diagrams given herein show only the fundamental units employed in the process.

There are many minor items of equipment, including a network of conveyors and airveying equipment, that are required to keep the material flowing through the required channels. The necessary instrumentation for proper control and for cost accounting purposes has been incorporated in the design. Wherever equipment will be in contact with wet or damp materials, it will be protected by stainless-steel cladding. The conveyors are of solid stainless steel, type 304. Large volumes of air, approximately 463 tons per 24 hours, must be moved for cooling purposes and for the removal of vapor from the process and from the building. This necessitates an elaborate system of ducts and fans. All pumps are of bronze or stainless-steel construction and all process piping of copper or stainless steel.

Magnitude of Operations

Some conception of the magnitude of the services required for this plant may be gained from the following data:

Steam Used per Pound of Water Evaporated

Rotary steam-tube dryers	1.25 lb.
Drum dryers	1.50 lb.
Quadruple-effect Evaporators and Finishing Pan	0.35 lb.

Services per 24 Hours

Steam	900,000 lbs.
Water	2,500,000 gallons
Electricity	9,000 K.W.H.

Predicted Light, Heat and Power Costs

Dark Grains	$17.85 per ton
Dried Solubles	$23.50 per ton

Recovery

100,000 lb. of product per 24 hours

The plant is designed for the complete recovery of fermentation residues of a distillery mashing 5,000 bushels of grain per day. To house it, a building is in course of erection, having outside dimensions of 58 ft. x 95 ft. x 75 ft. high. It is of steel frame and brick construction and will stand adjacent to the Company docks on the Detroit River. The building will rest on steel piling, driven to refusal at a depth of 96 to 110 feet.

A Promise Made and Kept

In November, 1948, hearings were held in Windsor by the International Joint Commission on Boundary Water Pollution to determine what steps could be taken by industries and municipalities on the Canadian side to eliminate pollution of the St. Clair River, Lake St. Clair and the Detroit River. These hearings followed similar hearings in Detroit, investigating pollution originating on the American side of these waterways. While the wastes from our Walkerville distillery have been responsible for only a very small fraction of the pollution, the Commission urged the immediate adoption of remedial measures and the Company representatives gave assurance that appropriate steps would be taken as soon as the supply of construction materials and the necessary equipment was assured. The present project is the outcome of that promise.

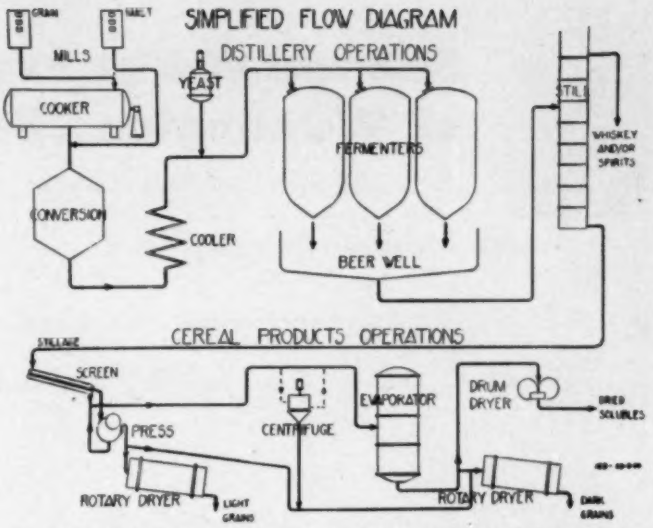


Fig. 6—Simplified flow diagram showing relation of recovery plant to distillery operations

In committing itself to this undertaking, the Company is risking a substantial amount of capital in the belief that, even if not highly profitable, the Recovery Plant will at least pay its way. At the same time, it will eliminate river pollution from the distillery. It is our hope that our example will encourage not only other industries but also any offending municipalities to do their share in correcting an unsatisfactory condition.

Engineering Hydraulics

John Wiley & Sons, Inc., New York, N.Y., has announced the publication of a new reference work, "Engineering Hydraulics", edited by Hunter Rouse. The book provides a comprehensive treatment of engineering hydraulics with special emphasis on hydraulic principles.

A special project of the Iowa Institute of Hydraulic Research, the volume represents the proceedings of the Institute's fourth hydraulic conference held in 1949.

Thirteen contributing authors have covered the fundamental principles of flow, hydraulic similitude, flow measurement, hydrology, flow of ground water, steady flow in pipes and conduits, surges and water hammer, channel transition and controls, gradually varied channel flow, flood routing, wave motion, sediment transportation and hydraulic machinery.

The book, a 1039 page volume, may be obtained from John Wiley & Sons, New York, N.Y., at $15.00 per copy.

Covington, Ky. to Clean Up Pollution of Ohio River

The Northern Kentucky Sanitation District No. 1 was formed to build collector sewers and a sewage treatment plant for Covington and thirteen surrounding communities. In the four years since its organization, the District has been working to make the community sanitation program a reality. Plans are now being completed by consulting engineers. To finance this phase of the program, the District levied a tax of 5 cents per $100 to secure funds for administrative and investigation expenses. Meantime, financing arrangements have been completed for the issuance of bonds to be retired by a sewer service charge.

The construction stage of the project is now under way, with work started on a collector sewer. Construction of the treatment works—to be located on a site west of Bromley, Ky., on the southern bank of the Ohio River—is scheduled to start this fall.

Total cost of the sewage collection and treatment program is estimated at $6,038,000 on the basis of present prices. Consulting engineers on the project are Vogt, Ivers, and Seaman of Cincinnati, and J. Stephen Watkins of Lexington, Ky.

Exhibits, sponsored jointly by the Ohio River Water Sanitation Commission, the Kentucky Water Pollution Control Commission, and the Covington Chamber of Commerce, are now being shown throughout the area to acquaint the people of the district with the benefits to public health and economic development that result from stream pollution abatement.

Sewage Works Program of Wilmington, Delaware

Part I—Interceptors and Pumping Station

by A. R. VOLLMER, *Partner, Whitman, Requardt and Associates, Baltimore, Md.*

A COMBINED city, county sewerage project estimated in 1949 to cost nearly $13,000,000 has been planned for Wilmington and the surrounding areas of New Castle County, Del. Designed to provide a single treatment plant in Wilmington on Cherry Island Marsh, east of the city, the program will permit the city and county to eliminate the discharge of raw sewage into nearby water courses and permit the abandonment of several small and inadequate treatment plants. Under the proposed scheme, interceptors will be built within the city and extend out to the county on the north, west and south from a point at 11th Street on the banks of Brandywine Creek. At this point a pumping station will be constructed, (the only one within the city limits) and an 84 in. force main will be constructed to the plant site about 6000 ft. distant. After receiving primary treatment, the plant effluent will be carried in an 84 in. plant outlet pipe a distance of 4000 ft. to the deep waters of the Delaware River and discharged.

The total cost of nearly $13,000,000 will require an expenditure of about $8,400,000 on the part of the city and $4,500,000 on the part of New Castle County. The latter amount is made up of $2,000,000 for interceptors and pumping stations plus $2,500,000 for trunk sewers. The City of Wilmington has completed plans and specifications for its part of the work and New Castle County has completed plans and specifications for the most urgently needed projects and has the remaining portion under design. Both the city and county are now proceeding with construction.

The design features of the interceptors and sewage pumping station will be discussed in this paper; the treatment plant for the city will be the subject of a subsequent article.

The program is being carried out as the principal project in Delaware's obligation under the "*Incodel*" (Interstate Commission on the Delaware River Basin), formed by New Jersey, Pennsylvania, Delaware and New York to study and recommend action, including control of pollution, for the best interests of the Delaware River which is so vital for all the signatory states. The Delaware Water Pollution Commission, created in 1949 by the General Assembly, has a primary interest in this program for it concerns the most highly developed area in the state.

Interceptor

The design features 43,000 lin. ft. of entirely new interceptors varying from 18 to 78 in. along Christina River and Brandywine Creek. Due to the heavy loading of industrial wastes, the diversion ratios from present combined sewers will be based on the "daytime" flows to minimize spillage into streams.

Population and Sewage Flows

It has been estimated that the ultimate population contributing sewage will be approximately 300,000, half within the City of Wilmington and half from county areas. At the present time about 200,000 people reside on the drainage areas, (120,000 in the city and 80,000 in the county). The sizing of the interceptors, however, has been determined by factors other than population alone. Since Wilmington's sewerage system is largely the combined type, having both sanitary sewage and storm water, the diversion ratio had to be determined for the amount of sewage to be intercepted. The extent, character and location of future industrial growth had to be estimated and the areas which would have the most important residential growth had to be determined. Allowance had to be made for infiltration and for peak flows which must be accommodated.

As shown on Fig. 1 the basic pattern of interceptors will follow the stream valleys and converge at the pumping station. Sewage from the county will enter the system from the north through Interceptor E, from the south through both branches of Interceptor D, from the west through sewers feeding Interceptors A and C. That portion of Wilmington south of the Christina River has been assumed most likely to develop industrially and the interceptors have been sized accordingly.

The summary of flows is shown in Table 1:

Table 1
POPULATION AND DESIGN SEWAGE FLOWS

Interceptor	Design Population	Sewage Flows in Million Gallons per day: Domestic & Commercial at 90 g/c/d	Industrial and Infiltration	Total Yearly Average	Design Flow to Interceptor
A (Incl. E)	60,000 N 50,000 W	5.4 4.5	10.1 11.0		
	110,000	9.9	21.1	31.0	68.5
B	15,000 W	1.3	6.4	7.7	42.0
C	50,000 N 80,000 W	4.5 7.2	5.1 4.2		
	130,000	11.7	9.3	21.0	72.2
D	40,000 N 5,000 W	3.6 0.5	3.0 3.2		
	45,000	4.1	6.2	10.3	18.3
TOTAL	300,000	27.0	38.9	70.0	201.0

W = Wilmington; N = New Castle County.

The allowance of 90 g/c/d for domestic sewage is based on a measured flow of 68 g/c/d plus an allowance for greater use of water with higher living standards. Allowance also has been made for infiltration from each of the sewer outlets based on the area which is served. The yearly average infiltration has been assumed to be 1,000 gal/acre/day (2,000 gal/acre/

day for wet season flow). The total yearly average flow of 70.0 mgd is the estimated ultimate flow to be considered for treatment plant capacity; the present total yearly average flow is approximately 30 mgd. The design capacity of the treatment plant is to be 40 mgd with space provided to permit the expansion to 70 mgd. The combined capacity of the interceptors is 201 mgd, or about 2.9 times the present average yearly flow, and about 1.4 times the estimate for the ultimate daytime flow of 140 mgd.

Excess Storm Water Diverted

It is prohibitive in cost and unnecessary to intercept all of the combined sanitary and storm water flow that reaches the sewers during wet weather. Usually an interceptor will have an overall capacity of 2.0 to 2.5 times the average ultimate dry weather flow in the sewer. Overflow above this flow does not result in any significant river pollution since the receiving stream usually has an increase in flow due to the same rain which caused the increased flow in the sewers. Many of the combined sewers in Wilmington will carry from 20 to 50 times the total flow of sanitary sewage during a heavy storm only a small part of which will be diverted to the interceptors; the remainder will overflow to the stream. Critical periods for such overflows are between June and November when dry periods in stream flow usually occur and when the odor nuisances from raw sewage discharge is at a maximum.

For Wilmington, no arbitrary rule was possible in the determining of a diversion ratio. As noted previously the combined capacity of the interceptors is nearly three times the total average yearly "dry weather" flow and about 1.4 times the estimate for the ultimate daytime flow. The ratios for the individual interceptors are given in Table 2.

Table 2
FLOW RATIOS

Ratio Between	Interceptors A	B	C	D	Average
Design Flow to Interceptor and Total Yearly Average	2.2	4.1	3.4	2.9	2.9
Design Flow to Interceptor and Total Daytime Flow	1.2	2.1	1.9	1.2	1.4

The amount of sewage overflow (during storms) to Brandywine Creek and the Christina River is of great importance in this project. Variations in design flow to the interceptors is based on a careful study of industries and industrial waste discharges in an effort to minimize the discharge of offensive material during storm flows. In Wilmington, tanneries scattered throughout the city, produce the most concentrated wastes, with 600 ppm. of suspended solids (about three times as strong as ordinary city sewage). The color of those wastes are far more noticeable than the solids. For sewage outlets high in tannery waste and located in industrial areas, a diversion ratio of 3.0 was applied to the computed ultimate daytime flow. Other industrial areas had factors of 2.5 and areas primarily domestic in nature had a factor of 1.2, both applied to the computed ultimate daytime flow. (Note that the diversion ratios have been applied to the "computed ultimate daytime flow" rather than to the average annual flow.) Flow characteristic of the existing outlets indicated that from 6 AM. to 6 PM., the amount of industrial sewage when added to domestic sewage produced peaks that justified a method of avoiding as much of the spillage of sewage from the "flushing out" of the sewers as possible. Therefore, daytime flows were determined for each outlet and applied to the average annual flow which in turn was developed from the domestic flow plus the industrial and infiltration flows.

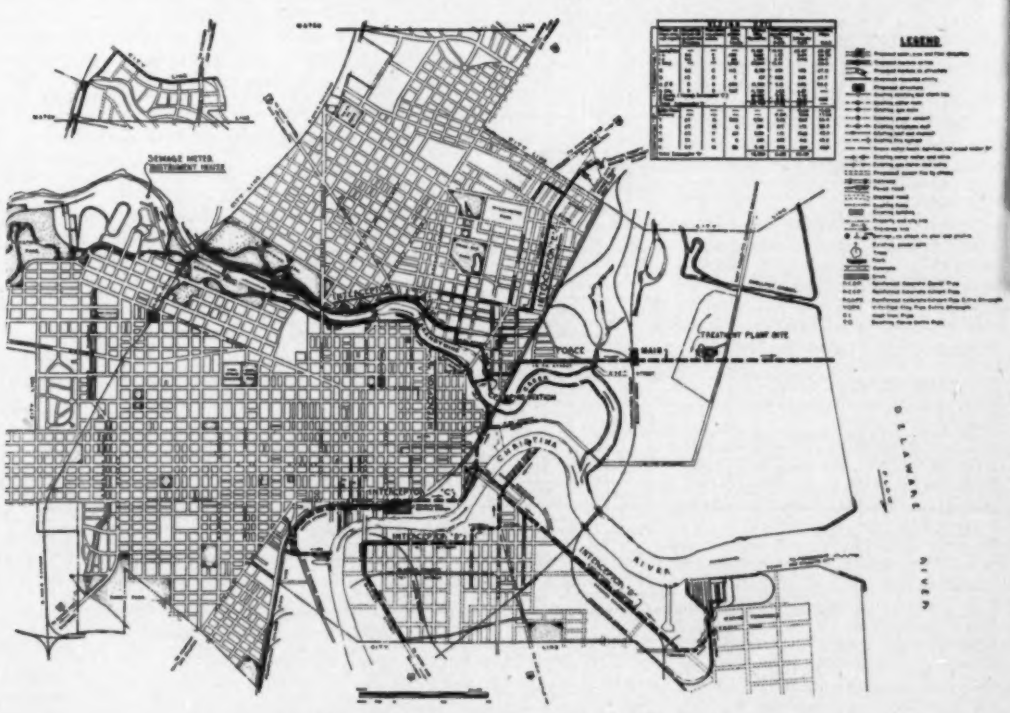


Fig. 1—Map of Wilmington, Del., Showing Location of Interceptors and Works

The resulting "computed ultimate daytime flow" gave a more satisfactory means for insuring that the diversion ratio was fulfilling the purpose of keeping the spillage to streams at a minimum.

Storm Water Studies

Duration and intensities of rainfall were studied so that the volume of storm overflow could be estimated. Records of the Weather Bureau at Philadelphia were used as there were no extensive local records. Studies were confined to June through November. A condensed summary of the analysis from 1940-44 is as follows:

DURATION OF RAINS
(June-November 1940-44)

Percent of time when rainfall intensity was	
.01" /hr.	0.77%
.02"-.03"/hr.	0.97
.04"-.07"/hr.	0.94
.08"-.15"/hr.	0.85
.16"-.31"/hr.	0.53
.32"-.63"/hr.	0.24
over .62"/hr.	0.07
Sum	4.37%

In this study the first 0.03 in. of rain at the beginning of each storm was deducted to allow for wetting the streets before runoff begins. These data mean for a combined system of sewers that for only 4.37 per cent of the time will there be enough rain to cause runoff to sewers and that for 95.63 per cent of the time the dry weather factors will govern the interception of sewage. Dry weather sewage flow as determined for Wilmington is equivalent to 0.01 to .02 in. per hr. depending on the size of industrial flows.

If the interceptors are designed to carry three times the average dry weather flow, (assumed to be equal to 0.01 in. per hr.) then the time of spillage or overflow would be (4.37 — 0.77 — 0.97) or 2.63 per cent of the time. If the dry weather flow were equal to 0.02 in. per hr. then the time of spillage would be (4.37 — 0.77 — 0.97 — 0.94) or 2.16 per cent of the time.

These studies showed that enlargement of interceptors is of little value in reducing the frequency of storm sewage overflows. For example, (from June to November), if the capacity of the interceptors were 3 x DWF, 3.5 overflows per month would occur, if the capacity were 8 x DWF, 3 overflows per month, and if the capacity were 20 x DWF, 2 overflows per month would occur. In terms of percent of sewage escaping, the values would be approx. 2 per cent for 3 x DWF, 1.5 per cent for 5 x DWF and 0.3 per cent for 20 x DWF.

Table 3
PROPERTY TRAVERSED BY INTERCEPTORS

	A, E & B	C	D	Total Ft.
Public Property				
Parks	8,280	1,380	950	10,610
Unpaved Streets	4,300	1,200	13,000	18,500
Paved Streets	920	2,300	2,300	5,520
Private Property				
Along Railroads	2,250	2,700	.....	4,950
Paved or surfaced area	100	.....	.....	100
Undeveloped	1,090	1,650	1,200	3,940
	16,940	9,230	17,450	43,620

Two Types of Diversion Structures

The interception of sanitary sewage from existing outlets takes place either by means of a float-operated sewage gate in a Regulating Chamber for average flows over 0.3 mgd. or in a Diversion Manhole by means of a fixed orifice for flows less than 0.3 mgd.

The float-operated sewage gate has been designed to operate on the water level downstream from the orifice. A diversion dam will be located immediately below the diversion orifice in the main sewer.

The fixed orifice type of diversion structure has been adopted for flows below approximately 0.3 mgd. because the float-operated gate is impractical for such low flows due to a small gate size and the danger of frequent clogging. A diversion manhole will be placed on the combined sewer in which a horizontal orifice is placed adjacent to the main stream. A diversion dam will be placed downstream from the orifice. Below the orifice (in most cases an upturned elbow) the diversion pipe leads to the interceptor.

The orifice itself is in a metal plate, not less than 4 in. in dia., and designed for ready removal for adjustment, repair and flushing.

Table 4
CONSTRUCTION COSTS—COMPLETE CITY SYSTEM—(1949 Est.)

Interceptors	
A, B and E, 16,940 ft., 30 to 60 in.	$ 800,000.00
Sewage Pumping Station, 165 mgd.	850,000.00
Force Main,	
9,740 lin. ft., 72 and 84 in.	1,200,000.00
Underwater Pipe Lines	300,000.00
Interceptor C,	
9,230 lin. ft.—66, 72, 78 in.	1,250,000.00
Interceptor D,	
17,450 lin. ft., 18 to 42 in.	450,000.00
Sewage Treatment Plant, and Engine-Generator Sets—40 mgd.	2,650,000.00
Total Construction Cost	$7,500,000.00
Engineering	450,000.00
Preliminary	15,000.00
Rights of Way	150,000.00
Legal, Administration and Contingencies	285,000.00
TOTAL PROJECT COST	$8,400,000.00

Under Water Siphons

Two inverted siphons are required; one to carry sewage from Interceptor "D" across the Christina (a maximum of 18.3 mgd. in two 24-inch cast iron pipes) and one to carry the combined flow of the Interceptors B and C across the Brandywine (a maximum of 132.5 mgd. through two 54 inch concrete pipes to the pumping station).

For the normal operation of the Christina Siphon, flows up to 12 mgd. will pass through one pipe at velocities up to 5.9 ft. per sec. Flows in excess of 12 mgd. will pass over a weir in the inlet chamber and place both pipes into operation. Flushing of the siphon, will be accomplished by electrically controlled sluice gate in the inlet chamber operable either by a time switch or manually. Either or both of the siphon pipes may be flushed with river water at 7 ft. per sec.

For the normal operation of the Brandywine Siphon, flows up to 75 mgd. will pass through one pipe at velocities up to 8 ft. per sec. For higher flows, a remote control device in the sewage pumping station will operate to place both siphon pipes in service. When storm flows decrease the same remote control device will automatically return the siphon to "one pipe" operation. An electrically controlled sluice gate in the inlet chamber will induce a flushing velocity of 9 ft. per sec. through either pipe when necessary.

Pipe Line Location

For both banks of the Brandywine and for the left bank of the Christina

Table 4-A
BIDS ON WORK AWARDED TO DATE

Wilmington Sewage Treatment Program:

Contract No.	Title	Awarded to	Low Bid
1	Interceptors A, B & E	James Julian, Wilmington, Del.	$ 927,476.60
2	Pumping Station	Vanguard Construction Co., New York	979,891.00
3	Force Main	Utilities Construction Co., Inc., Baltimore, Md.	1,249,238.00
4	Underwater Pipelines	The Leo Butler Co., Washington, D.C.	359,275.00

New Castle County Sewerage Program:

Contract No.	Title	Awarded to	Low Bid
1950-12	S. Delaware Interceptor Section II	Henry C. Eastburn & Son, Inc. Newark, Del.	$ 168,081.00
1950-15	S. Delaware Interceptor Section III	George & Lynch, Inc. Wilmington, Del.	132,532.00
1950-16	Buttonwood Pumping Station	James Julian, Wilmington, Del.	45,600.00
1950-17	N. Brandywine Interceptor	George & Lynch, Inc., Wilmington, Del.	163,685.24

(Interceptors A, B or C) it will be necessary to thread the pipe locations through industrial property, railroad rights of way, a ship yard, downtown streets and similar developed areas as well as through parks and other lightly settled riverbank areas. For the right bank of the Christina (all of Interceptor D) the pipe lines for the most part will be located in the unpaved road shoulders along highways. The development in the South Wilmington section served by Interceptor D is fortunately relatively light and the pipes will have little surface or underground obstruction. Table 3 shows the property traversed by the interceptors and Table 4 gives the construction costs.

Sewage Pumping Station

The decision to locate a treatment plant on Cherry Island Marsh, east of the city and now undeveloped, was one of the major factors in the selection of the site for the sewage pumping station. The location of a plant in this area with a discharge directly to the deep waters of the Delaware River meant economies of first cost and annual cost since primary treatment will be sufficient. A plant discharging effluent to either the Christina or the Brandywine, upstream from the Delaware, would require secondary treatment and being closer to the city would have been more objectionable from many standpoints.

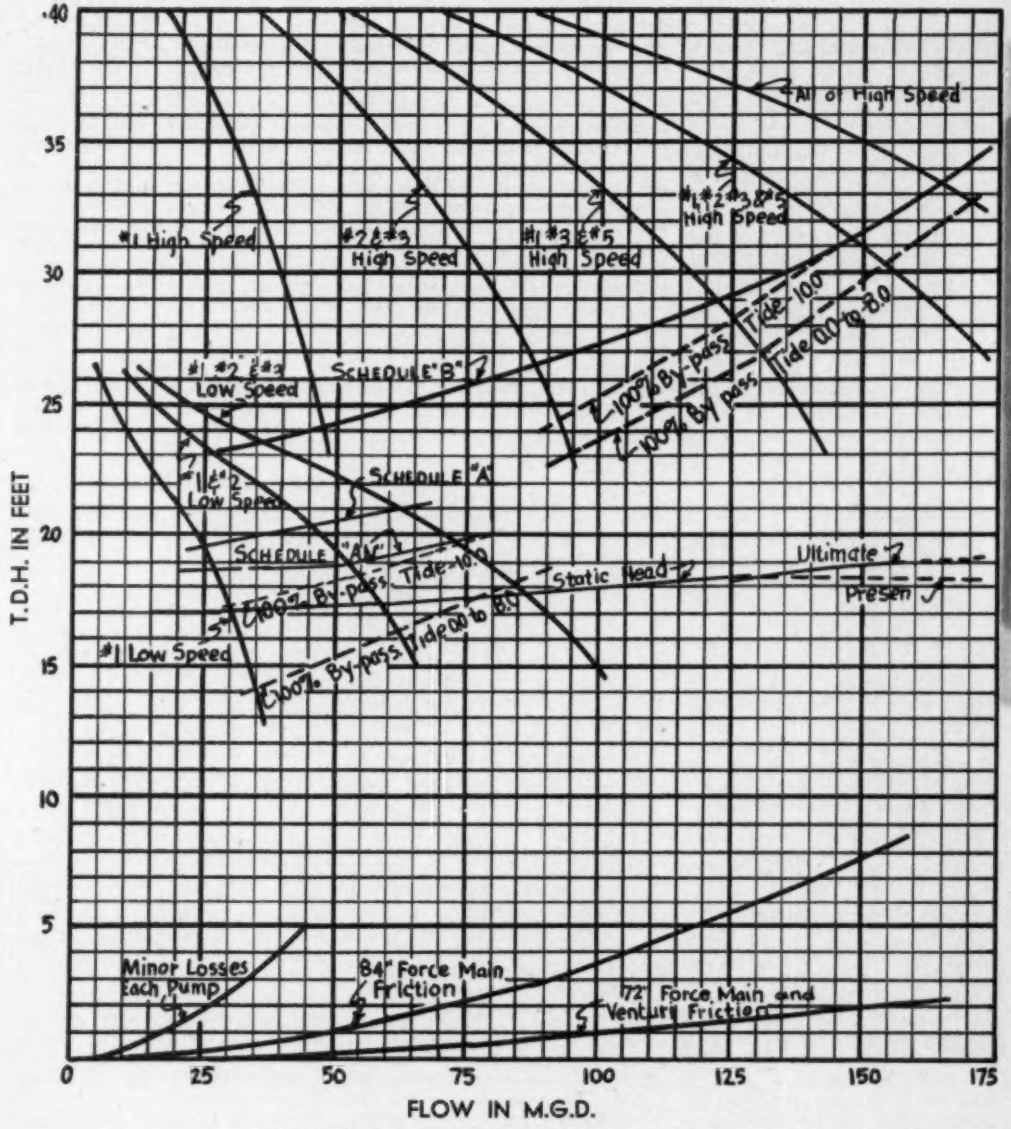


Fig. 2—Graphical Representation of Heads for Different Pumping Arrangements

It was obvious that the treatment plant should be located with respect to largest sewage and industrial waste outlets near the central part of the city. Correspondingly, in selecting the site for the sewage pumping station consideration was given to the following factors:

a)—Minimum possible length and size of interceptors leading to the pumping station.
b)—Minimum possible length of force main from the pumping station to the sewage treatment plant.
c)—Minimum number of river crossings (siphons).
d)—Possible rock foundation with a minimum of rock excavation.
e)—Accessibilities of existing roads and utilities for economies in construction cost.

A station site on Brandywine Creek near the eastern edge of the city development, as shown on Fig. 1, fulfills these conditions. A location at the lower end of Interceptor A, opposite the lower end of Interceptor B, makes it possible for Interceptors C and D to be brought to the station with a minimum length of sewer needed for collecting sewage from existing outlets. The force main to the treatment plant can be of minimum length. River crossings can be held to two. Rock borings indicate that the station will be founded on rock, but the pipe lines coming to the station will be slightly above rock.

Pump Capacities

Since the sewers carry sanitary sewage and large volumes of industrial waste, as well as storm water, the pumping station must have a wide capacity range. Combined maximum flows will occur during every period of wet weather regardless of the contributing population from city and county areas. The determination of the diversion ratios for the various interceptors and the diversion structures that were needed was discussed above. The flows for which pumping capacities had to be provided may be re-summarized as follows:

Minimum present dry weather nighttime	10 mgd.
Minimum present dry weather average	30 mgd.
Ultimate design dry weather average	70 mgd.
Ultimate design dry weather daytime average	140 mgd.
Present and Future Interceptor capacity	200 mgd.

It was decided that the range of flows for which the station should be designed should be from about 25 to 165 mgd. Sewage flows below 25 mgd. will be pumped on an intermittent flow basis. Flows above 165 mgd. will overflow at the siphon chambers. Additional system capacity can be obtained if partial bypass to the Delaware River takes place at low river stages.

Economies of various combinations of pump capacities and pumps were studied including constant speed, two-speed and variable speed pumping units. The optimum combination proved to be five identical pumps, connected to two-speed motors. Each two speed unit will handle 25 mgd. at low speed and nearly 50 mgd. at high speed. The recommended operating schedule calls for the use of three units at low speed for dry weather operation up to about 65 mgd. and for the use of high speed units for wet weather operation from 50 to 165 mgd. Fig. 2 shows graphically the operation schedule.

Advantages of identical pumps include interchangeability of parts and use of identical large sized valves and fittings to give maximum flexibility. Use of two speed pumps results in savings of space as well as savings in cost of large valves and fittings at the relatively slight increase in cost of motors and controls. When five pumping units are designed as described above, the flow combinations that are obtainable give very satisfactory flow increments. In effect, five two-speed pumping units are equivalent to ten separate constant speed pumps.

Force Main

The length of force main to be constructed between the pumping station and the treatment plant is 6,000 feet through relatively flat and open country although somewhat marshy at the treatment plant end. No difficulties will be experienced in vertical alignment. It will be possible to have a gradually descending grade from the Venturi meter outside the station to a low point about midway between the pumping station and treatment plant for blow-off and then to have a gradually ascending grade to the treatment plant. The principal factors given consideration in selecting the proper force main size were:—

1)—Electric power consumption at peak flows
2)—Interest and carrying charges on first cost of pipe lines
3)—Proper cleansing and scouring velocities in the force main
4)—Power consumption of weighted average sewage flows during next 30 years (life of bonds)

Giving consideration to these criteria, the pipe line should be either 72, 78, or 84 in. in diameter. The weighted average future pumpage will be between 40 and 60 mgd. For these comparisons 50 mgd. will be used. The static lift through the force main will be 17 feet and the total dynamic head at 50 mgd. will vary from 21 feet to 24 feet for all three sizes under consideration. At full capacity of 165 mgd. the 84 in. size would have a TDH of 31 ft.; the 78 in., 35 ft.; and the 72 in., 41 ft. The total maximum power load would be 1000 hp. with the 84 in., and 1300 hp. for the 72 in. The variation in velocity at the varying rates of flow is given in the following tabulation:

Velocity in Force Main in Ft./Sec.

	25 mgd	50 mgd	165 mgd
72 in.	1.37	2.74	9.02
78 in.	1.17	2.34	7.68
84 in.	1.01	2.02	6.65

Rates of 25 and 50 mgd. have been selected to correspond with the low pumping rates.

The adopted size of 84 in. dia. was based on an economic study giving proper weight to the above design factors. For flows below 25 mgd. which would require intermittent pumping, provision was made for flushing at high velocities with creek water if storm flows were too infrequent. The Brandywine Creek siphon at the pumping station is designed to permit river water to enter the system to supplement low sewage flows for flushing purposes, when desired.

Trash Racks and Fine Screens

Large diameter combined sewers with a variety of openings through which large objects could reach the sewers makes it necessary to provide protection for the pumps. Mechanically cleaned trash racks of 4 inch openings will prevent large floating objects from reaching and damaging the sewage pump impellers. Vertical type racks, to operate either by time clock or manually, will lift material into a waiting truck for hauling from the site. Only one truck per day of debris is expected, except during times of continued storm.

The industrial character of Wilmington sewage carries a heavy load of scrap leather, rags and other debris that is also likely to interfere with pump operation. Even with pumps of large size screening appeared to be desirable. Since screening or comminuting would be required at the treatment plant ahead of the grit chambers and clarifiers, it was decided to install screening at the pumping station ahead of the pumps. Mechanically cleaned screens, with 1-inch openings will be installed immediately following the trash racks in the channels leading to the wet wells. Operation will be by time clock or by differ-

ence in sewage level at the screens.

Screenings will be comminuted prior to being returned to the sewage wet wall. The use of comminutors for this purpose along with screens will require a small amount of pumped sewage with the screenings for dilution and for carry or flushing purposes. Studies showed that if comminutors were to be used directly in the sewage stream instead of screens, more units would be required, with more complex channels and controls and greater cost.

Pumping Schedules

The station will operate on two distinct and independent pumping schedules. Schedule A will be used during normal dry weather flow when three pumps are operating at low speed as shown on the system curve, Fig. 2. Schedule B will be used during storm flow when the pumps are operating at high speed. There will be a modification to Schedule A and known as Schedule A-H for dry weather flow in which the starting sewage levels will be somewhat higher in order to save pumping head when advisable. These schedules are shown in Table 5.

With Schedule A or A-H one screen channel and one wet well will be used. When storm flows call for Schedule B both screen channels and both wet wells will be used. Since the electricity for the pumping station will be furnished from the sewage treatment plant with two dual-fuel sludge gas-burning engine generators, it was important that the sewage plant operator control the pump operation. Accordingly, remote controls are to be installed so that the schedule of pumping A, A-H, or B can be determined and set by the operator at the plant. Under normal or dry weather conditions one engine only will be needed to furnish electricity for the three sewage pumps at low speed. If the sewage level continues to rise in the wet well, as would occur during storms, an alarm bell will ring at the sewage plant. When this occurs, a second engine can be placed "on the line," a few minutes prior to the demand for current. After a storm, when pumping demand has been sufficiently reduced, the pumping station can be automatically returned to the dry weather schedules. The sluice gates for the second screen channel as well as the valves at the pumps are interlocked for proper remote control. Alternation of screen channels, wet wells, pumps, sluice gates, valves and controls will be possible so that maintenance, repair and adjustments can be done. All pumps will be operated by a pneumatic or "bubbler" system which will start and stop pumps on the designated pumping schedule.

Table 5
PUMPING SCHEDULES

	Dry Weather Flows (all pumps at low speeds) Elevation in Wet Well				Wet Weather Flows (all pumps at high speed) Elevation in Wet Well		
	Schedule A		Schedule A-H		Schedule B		
	Start	Stop	Start	Stop		Start	Stop
Pump No. 1	—3.3	—4.3	—1.6	—3.6	Pump No. 1	—3.3	—4.3
Pump No. 2	—3.0	—4.0	—1.3	—2.3	Pump No. 3	—3.2	—4.2
Pump No. 3	—2.7	—3.7	—1.0	—2.0	Pump No. 5	—3.1	—4.1
Pump No. 4	used during alternate weeks (alternates with No. 2)				Pump No. 2	—3.0	—4.0
Pump No. 5	used during alternate weeks (alternates with No. 1)				Pump No. 4	—2.9	—3.9

Station Layout

A typical cross section of the station is shown in Fig. 3. Two 54 in. siphons bring sewage across Brandywine Creek from Interceptors B and C and are joined in the collecting chamber by the 60 in. Interceptor A. In the collecting chamber, sluice gates direct the sewage flow to one or two

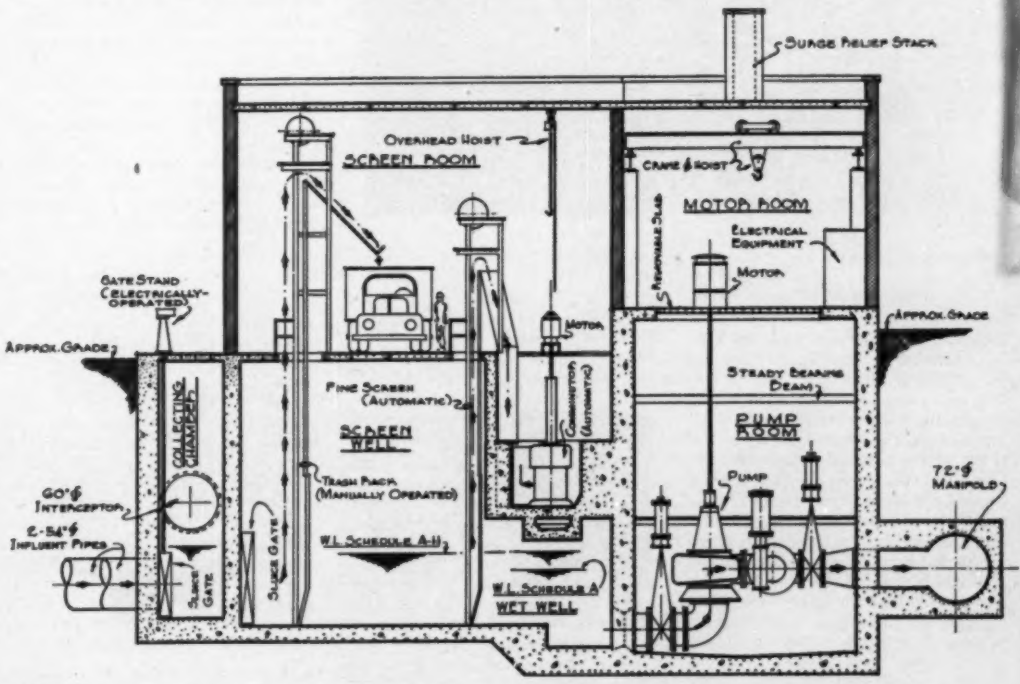


Fig. 3—Cross-section of Pumping Station

screen channels, each six feet wide. Here the mechanical trash racks and the mechanical screens remove debris and screenings. Two comminutors, one for each screen, are located adjacent to the screens and over the sewage level in the wet well for the direct discharge of screenings.

Pump No. 3, being located in the center of the battery, has been designed as a swing pump to take suction from either of the two wet wells by means of a tee connection with two suction valves so that maximum flexibility of pump operation could be achieved. All pumps are to be of the vertical shaft type having 36-inch suction and 30-inch discharge. Hydraulically operated 30-inch cone valves will control the normal operation of pumps. In addition, gate valves, also hydraulically operated, on the suction and discharge will be installed to isolate pumps and cone valves. On the discharge side of the pumps, all force main connections are identical. The force main manifold is outside the building and will be 72 in. in diameter for a distance of 125 feet from the station where the Venturi meter is to be located in an underground vault. The Venturi meter has been specified to be of the eliptical throat type having a full 72 in. vertical dimension with a width of approximately 15 in. at the throat as an aid toward avoiding grit and air troubles. Beyond this point the force main will be 84 in. to the treatment plant.

The consulting engineers for the entire program were Whitman, Requardt and Associates of Baltimore, Md., with Roy H. Ritter, partner, as Project Engineer. The work was carried out under two separate and distinct engineering assignments—one for the Street and Sewer Department of Wilmington under Edwin F. Koester, Chief Engineer, and one for the Levy Court of New Castle County, under John I. Cahalan, County Engineer, through Feby. 1951, and now under John Taylor, County Engineer for the term beginning April 1951.

It has been considered fortunate that a single engineering office could have the concurrent assignments to solve and recommend facilities for the elimination of pollution on a regional basis giving consideration to drainage areas and not man-made political boundaries. Having maps, studies, work sheets, and costs from both city and county readily available expedited the work tremendously and permitted maximum coordination of effort and maximum consistency of design data and assumption. The layout and features of the 40 mgd. treatment plant will be discussed in a forthcoming article.

Wisconsin Sewage Short Course Draws 100 Plus

Sewage plant operators and superintendents from villages and cities throughout Wisconsin went back to school this spring at the University of Wisconsin to get the latest information on such sewage problems as sedimentation practice, sewage flow measurement, sludge digestion and disposal, and equipment maintenance, to help them operate their plants in their home communities as efficiently as possible.

Shown in the accompanying photo taken at a laboratory class in the University's hydraulic and sanitary engineering building is a group studying sludge digestion and disposal problems. They are, left to right, H. N. Kingsbury, Madison, of the Committee on Water Pollution of the State Board of Health, who is on the faculty of the sewage plant short course; Russell Stewart, Ladysmith; Gerald W. Lawton, Madison, University instructor in civil engineering, also a member of the faculty; Harold Martin, Mukowonago; Ralph Bahr, Spring Valley; and Joe Moenssen and A. A. Fryklund, both of Prentice.

More than 100 plant operators and superintendents from municipalities throughout Wisconsin attended the sewage short course held on the Univ. of Wisconsin campus. Sponsored by the League of Wisconsin Municipalities and the Conference of Wisconsin Sewage Works Operators, the short course was conducted by the staffs of the State University Hydraulic and Sanitary Engineering laboratory, the State Laboratory of Hygiene, and the State Board of Health.

ASTM Standards On Industrial Water

American Society for Testing Materials, Philadelphia, Pa., has prepared the second edition of "ASTM Standards on Industrial Water", by ASTM Committee D-19 on Industrial Water. The publication brings together in convenient form 31 various ASTM standard and tentative methods of sampling, analysis, corrosivity tests, methods of reporting and testing of industrial water.

A list of ASTM Symposiums and technical papers on industrial water is included, and copies of this 168-page compilation, can be obtained from American Society for Testing Materials, for $2.00 each.

"See what I mean? D'ya think there's a chance of borrowing one of your worn out hydrants for planting in our back yard?"

Sixth Purdue Conference On Industrial Wastes

*Third and Concluding Installment**

Session Chairmen

W. H. Wisely
Exec. Secy.
Fed. Sw'g. Wks. Assns.
Champaign, Ill.

A. P. Trocmper
Engr.
Ill. San. Water Bd.
Springfield, Ill.

IT is regretted that this concluding installment of our report covering the record making 6th Purdue Industrial Waste Conference, scheduled for our June issue, had to be held over for this issue.

To repeat from a previous installment, the coast-to-coast attendance of almost 400 registrants from 27 states and Canada is indicative of the interest manifest in this Industrial Waste Conference. This pioneering enterprise has won national recognition for itself and its originator and continuing main-spring chairman, Don E. Bloodgood, former superintendent of sewage treatment, who was picked by R. B. Wiley, head of Purdue's School of Civil Engineering, to headup and develop the Sanitary Engineering Department of the University.

So much for the deserved "bouquets"; now down to business.

Pollution and the Control Agencies

Early in the program CHARLES M. HENDERSON, attorney for the Federal Security Administration, presented an illuminating review of the present status of pollution control at the Federal, State and Local Levels. He pointed out that there was a real hazard in having more than one agency in a given state in charge of pollution control. He also called attention to the variation in pollution laws and regulations of the various states and the need for greater uniformity in such regulations if state control was to prove wholly successful over a period of years. It had, therefore, been with this in mind that former state sanitary engineers now in the U.S. Public Health Service had produced what may be termed a model pollution control act based on what is considered the best features and most practical requirements of the numerous existing pollution control laws.

Mr. Henderson, looking into the future saw the need for the following:

(1) Standardization of pollution control acts.

(2) Such state acts to be administered by a single State Agency.

(3) Establishment of River Basin Authorities.

(4) A Water Resources Policy at the National level.

Activated Sludge Process for Milk Plant Wastes

"A NEW DESIGN OF ACTIVATED SLUDGE PLANT TO TREAT MILK WASTES" was described by Paul M. Thayer, Distr. Mgr., Chicago Pump Co. who told of the results attained at two going plants. Basically the plant is designed and process regulated to eliminate the sludge problem through its "wet-burning" in the aeration units which provide 39 to 41 hours of aeration and rapid recirculation of sludge in ratio of 300 to 400% of milk waste input regulated from holding tanks providing storage to the extent of 50% of the 24 hour average volume of waste. Air input is regulated to provide 20 to 28 cu.ft./gal. of waste, as may be required. The results have been a dependable effluent showing 96+% B.O.D. removal—one plant reducing 567 parts to 19 parts in effluent; the other showing 673 parts reduced to 31 parts. After 3 months of operation no sludge had been removed from the system, making what appeared to be an ideal process for small, if not also for larger milk plants.

Speakers

Chas. M. Henderson
Attorney
Fed. Security Adm.
Washington, D.C.

Paul M. Thayer
Distr. Mgr.
Chicago Pump Co.
Chicago, Ill.

Session Chairmen

A. J. Steffen
San. Engr.
Wilson & Co.
Chicago, Ill.

H. S. Kline
Engr.
Frigidaire Div.
Dayton, O.

The two plants in question are those of the George Schell Creamery, near Germantown, Ohio, and the Blossom Hill Dairy in Dayton, Ohio. At the former no holding tank was required because of the continuous discharge of waste over the 24 hour period and the air requirement had been 5,880 cu.ft. per pound of B.O.D. in the waste treated. In the second plant with a waste almost twice the B.O.D. value of the former, but with the holding tank, the air requirement had been only 3,570 cu.ft. per pound of B.O.D. in the plant waste. Major considerations of interest to the plant managements had been the low first cost of treatment plant and freedom from close supervision and operation problems—sludge disposal in particular.

Oil Separation by Flotation and Precipitation

"OIL SEPARATION BY FLOTATION AND SEDIMENTATION" was discussed by R. N. Giles, Director of Technical Services, Standard Oil Co., Chicago, Ill.

Mr. Giles described a separation plant of 80 mgd. capacity designed to meet Am. Petroleum Institute standard design of 1941. The plant consists of 34—2 stage settling units providing 17 min. detention in primary and 26 min. in secondary units. Sludge 3 to 5% of waste volume went to lagoons and waste. Recovered oil skimmed from tanks proved to cost the company twice that of new oil of equal quality. Residual oil in effluent varied between 9 and 107 ppm. in summer without adequate explanation. The average in effluent at 60 degrees was

*Previous installments appeared in April and May.

Speakers

R. N. Giles
Tech. Director
Standard Oil Co.
Chicago, Ill.

H. Schindler
Tech. Director
Daugherty Refinery
Petrolia, Pa.

55 parts and at 85 degrees 50 parts. The results from the installation had been an overall tightening up of losses from the plant to 20% of that recorded in 1948.

Mr. Giles, in reply to questions, favored the socalled Sun Oil Co. method of testing effluents for oil content—a benzine extraction method. Sampling was done with a continuous Zenith Meter Sampler.

A member reported that A.P.I. separators at his plant had consistently turned out an effluent of 30 ppm., or less, oil content on average. And, it was mentioned that Oliver Drum Filters are being more prevalently used to further reduce oil in effluents.

"Chemical Flocculation of Refinery Waste Water Separator Effluent," by R. J. Austin and E. H. Vause, Research Engineers, Standard Oil Company, Whiting, Ind.

Using an Accelator pilot plant unit with 25 ppm. $FeSO_4$, 10 ppm. Activated Silica, and 150 ppm. Dolomitic lime, the following results were obtained. Oil was reduced from 60 to 5 ppm., odor from 20,000 to 1,000, turbidity from 150 to 10 ppm., suspended solids from 25 to 10 ppm., C.O.D. from 190 to 60 ppm., and B.O.D. from 60 to 30 ppm. The treatment is effective on suspended solids and colloids but not on dissolved solids. Sludge from the process is vacuum filtered and burned.

Wastes from White Oils and Petroleum Sulfonates

"Treatment Plant for Wastes from Refining of White Oils and Petroleum Sulfonates" and the development of the most effective treatment procedures was described by H. Schindler, Tech. Director, Daugherty Refining, Petrolia, Pa.

In a rather detailed and complete paper, which we hope to print in full in a later issue, Mr. Schindler described early laboratory studies and plant design which involves acidification of sulfonation process wastes to pH5 and the addition of lime to precipitate calcium sulfonate at a pH of 8. or thereabouts. Improved precipitation can be had with ferrous sulphate, addition and extra lime to reach pH 10.

After 2 years of operation much economy had resulted from further studies in which an acidic waste mixed with the sulfonate waste had reduced acid required and improved precipitation without ferrous sulphate. Net result improved effluent and lime dosages reduced from original 1,400 lbs./10,000 gal. of waste to 220 lbs.

The plant consists of holding tank, rubber lined piping, two conical bottomed 8 min. mixing tanks lined with acid proof brick and equipped with Walker Process Co. equipment, sedimentation tanks providing 2 hr. detention equipped with Walker Sludge Removal Units. Sludge is conveniently piped to an abandoned mine serving as a lagoon of unknown capacities. The full scale plant produces effluent indicative of a 98% removal of color and oxygen consumed value. A point of primary interest is that the operations as developed over a period of one year require but 150 lbs. of lime per 10,000 gals. of waste as compared with 10 times that amount indicated in laboratory studies and early plant operation.

Linn H. Enslow, editor of "Water & Sewage Works," stated that the most impressive part of Mr. Schindler's paper was the disclosure that one should never be satisfied with experimentation on a laboratory scale as being the end answer. Costs figured on small scale tests might prove discouraging until at least a fair sized pilot plant test was run and improvements made therefrom. Mass reactions in chemical treatment possessed values not realizable in small scale demonstrations. The Daugherty experiences were ample proof of the economic importance of large scale experimentation with unpredictable processes of waste treatment as with most processes of a chemical-physical nature.

Cyanide Disposal After the Plating Cycle

"A Method of Continuous Chlorination to Destroy Cyanides in Rinse Waters" was described by C. F. Hauri, Plating Engr., Delco-Remy Div. G. Motors, Anderson, Ind.

Mr. Hauri told how very simple the continuous chlorination of cyanide rinse-water could be in a closed system wherein the rinse bath is recirculated through a Wallace & Tiernan Chlorinator and returned to the rinse tank, the only new water added being make up. Caustic soda is added to maintain a pH of 9 to 10 in the tank and create hypochlorites in passage through the chlorinator injector. Residual free chlorine of 1 to 2 ppm. is maintained. The equipment complete with recirculation pump cost $3,000, applying 80 lbs. of chlorine per 24 hours. Mr. Hauri reported that 3 to 3.5 lbs. of chlorine is required to destroy 1 lb. of cyanide. At Anderson it cost 50 cts. per hour for the caustic and chlorine. The process is automatic, in that the plating cycle will stop if chlorine is not going into the recirculated rinse waters. The overall result is a mixed plant effluent carrying not more than 2 ppm. residual cyanide which is acceptable in the Anderson sewer system and treatment plant.

A member pointed out that the innocuous cyanates produced by chlorination will revert to the undesirable cyanides if left for long in contact with organic matter.

Pickling Waste and Vacuum Filtration

"Vacuum Filtration a Practical Solution of the Pickling Waste Problem" was the claim of Edgar F. Guillot, Asst. Sales Mgr. of Filtration Engrs. Inc. of Newark, N.J. if not the exact title of his paper.

With the string-discharge *FEINC* Vacuum Filter small scale tests run at mills developed the fact that precipitation of the waste with lime and immediate vacuum filtration constitutes a practical method of treating such wastes. Illustrated with lantern slides in color, Mr. Guillot described the operations wherein continuous lime applications to the undiluted spent pickling waste followed immediately by vacuum filtration produced a filter cake ½ inch thick and of 60% moisture content for carting away to lagoons or a dump. The optimum pH of the limed waste was 9.5 or more. The rate of filtration maintained was 20 gals. of iron slurry per hour per sq. ft. of filter surface. A study of limes for efficiency and economy showed that high grade chemical lime

Speakers

C. F. Hauri
Plating Engr.
Delco-Remy Div.
Anderson, Ind.

Edgar F. Guillot
Asst. Mgr. Sales
Filtr. Engrs. Inc.
Newark, N.J.

in slurry form produced a filtration rate 30% above that with dolomitic lime. Dry chemical lime produced the best filtering sludge but a longer time was required for complete reaction. Interestingly the warm to hot filtrate served as an ideal lime slaking liquor, requiring about ⅓ gal. per pound of lime as compared with 1 gal. of water per pound. The filtrate was also found acceptable for re-use in making up pickling solutions.

The first large plant, at a cost of $35,000, is that of Walker Bros. at Conshohocken, Pa., where 7,000 gals. per day of waste liquor will be filtered.

Wool Scouring Waste Treatment Research

"RESEARCH ON WOOL SCOURING WASTE TREATMENT" was the subject of a review of progress by H. W. Webber, Director, State Experiment Sta., Lowell Textile Institute, Lowell, Mass.

Pointing out that raw wool contains 20% of so-called wool grease (esters and waxes) and 20% of water solubles, called "swint," Mr. Webber stated that grease and "swint" is removed by washing with soaps and alkali, or other detergents. More recently volatile solvents have come into use. Extraction with trichlorethylene is perhaps the newest development and such extraction and solvent recovery bids fair to become the best solution to stream pollution while also producing a better wool. Wastes from alkali and detergent washing will run to 7000 parts alkinity (pH 9.1) and contains saponified greases and waxes.

Mr. Webber related prevailing processes of removal and recovery of the socalled wool-grease. The acid cracking process in which the grease is released with sulphuric acid and dropped out as sludge which is filter-pressed. The cake containing 15% grease is extracted with solvents. The degreased cake after laying on the ground for a year can be ground and used as fertilizer.

Session Chairmen

R. A. Larson
Exec. Secy.
Ind. D'ry Prod. Assn.
Indianapolis, Ind.

*H. T. Rudgal**
Supt.
Water & Sewage Wks.
Kenosha, Wis.

**President, Central States Sewage & Ind. Wastes Assn.*

Calcium hypochlorite treatment involves addition of this agent to the waste. The grease is released and precipitated. The supernatant liquor from fill and draw tanks contains 500 to 600 ppm. B.O.D. which may be treated on trickling filters or discharged to municipal sewer systems. The sludge is mechanically filtered, heated and the grease filter-pressed out. The process offers considerable promise.

Mr. Webber pointed to the septic conditions, as would be expected in wool scouring plants, and the need of processes which preclude this condition which increased the B.O.D. of the plant wastes. He again emphasized more attention to the use of synthetic detergents and solvents; also the possibility of "tailor made" detergents and solvents and the advantages of antiseptic operations.

The question was raised as to the effectiveness of controlled digestion such as that instituted at Lebanon, Tenn. Mr. Webber answered that the results had to date been inconclusive.

Partial Treatment of Dairy Plant Wastes

"PLAIN AERATION AS PARTIAL TREATMENT FOR DAIRY WASTES" was reported upon by S. R. Hoover and N. Porges, Chemists, Research Labs., U.S. Dept. of Agriculture, Philadelphia, Pa.

In this experimental aeration, involving 6 hours of air diffusion followed by sedimentation in fill and draw units, a major reduction in carbohydrates is attained—53 parts in raw waste being cut to 2 parts in aerated supernatant and 7 parts in the sludge. The chemical, oxygen, demand (C.O.D.) of the settled aerated waste is cut to 600 ppm. which may be sufficient treatment for many conditions.

Treating Powder Plant Wastes

"TREATMENT OF POWDER PLANT WASTES" was reported upon by B. W. Dickerson, San. Engr. and Chemist, Hercules Powder Co., Wilmington, Del.

It will prove impossible in this type of digest to do justice to the work reported upon by Mr. Dickerson because of the area of experimental work covered and the details reported. His paper will be published in a later issue and deals with studies on small plant scale in the treatment of the acid wastes and organic wastes from smokeless powder plants which lead to the design and construction of full sized plants the results from which were also reported.

Speakers

B. W. Dickerson
San. Engr.
Hercules Powder
Wilmington, Del.

R. J. Dougherty
San. Engr.
H. J. Heinz Co.
Pittsburgh, Pa.

The acid wastes from the nitrating plant are neutralized with lime to a pH of 5, with fully automatic control. The organic wastes did not yield to chemical precipitation. After studying 2 stage aeration and trickling filters the latter were chosen and operated in series with applications of 20 mgd. per acre productive of effluents with B.O.D. values from 100 to 500 ppm. In operation, a dilution of the incoming wastes with 20 volumes of effluent to 1 of waste is practiced to maintain the 20 mgd per acre dosage. As long as no more than 2.5 lbs. of B.O.D. per cu.yd. of stone is applied to the primary filter (stone size 2 to 3 inch) the efficiency holds above 90%. As long as the loading of 5 lbs. of B.O.D. per cu.yd. was not exceeded in the secondary filter operation results were satisfactory.

Food Canning Wastes Treatment and Disposal

"THE TREATMENT AND DISPOSAL OF FOOD CANNING WASTES" as discussed by R. J. Dougherty, San. Engr., H. J. Heinz Co., Pittsburgh, Pa., proved to be an exceptionally meaty paper.

Starting with lagooning of food wastes, Mr. Dougherty warned against attempting to lagoon meat wastes because of the local nuisance aspects and creation of bad public relations. Vegetable wastes can be successfully lagooned with addition of nitrate of soda to suppress odor production with careful operation. The minimum dilution for lagoon effluents must be at least 5 to 1 and preferably 8 to 1. Again he warned of the dangers of local nuisance from lagoons and the attraction or breeding of insects.

As to chemical precipitation, Mr. Dougherty reported that screening on vibratory 40 mesh screens followed by ferric iron and lime precipitation with careful control will produce a B.O.D. reduction of 82%. The most economical disposal of the screenings and sludge is lagooning. Vacuum filtration has proved too expensive

Session Chairmen

F. W. Mohlman
Chief Chemist
Chic. San. Distr.
Chicago, Ill.

R. A. Canham
San. Engr.
Natl. Canner's Assn.
Washington, D.C.

because of the low filterability of the sludge and short filter-cloth life. Cost of operating chemical precipitation plants has averaged $150.00 per million gallons. The process is subject to control and varying the degree of treatment to meet conditions such as available dilution or the discharge of effluent to municipal sewers.

As to biological treatment Mr. Dougherty stated that in combination with municipal sewage an appreciable quantity of food canning wastes can be added to the municipal sewage without appreciably affecting the efficiency of trickling filter plants. Where the ratio of 0.3 canning wastes to 1.4 municipal sewage existed the average B.O.D. removal had only been lowered to 84% from 89.6% for sewage alone. Suspended solids removal had not been lowered any.

Mr. Dougherty then disclosed the results of a study of the comparison of chemical oxygen demand (C.O.D.) and biological oxygen demand (B.O.D.) as the yardsticks for evaluation of pollution removal in waste treatment. He hoped to see a more practical test developed for industrial waste treatment than the B.O.D. test and felt that so far as food wastes are concerned the C.O.D. test was preferable. It had proved entirely satisfactory as an operation control test—rapid and subject to exact manipulation and checking of results. On pea and corn canning wastes a consistent ratio existed between the chemical demand and biological demand tests.

Disposal of Poultry Dressing Plant Wastes

"Lagooning of Poultry Dressing Wastes" was described by Perry E. Miller, Chief of Industrial Wastes Section, Ind. State Dept. of Health, Indianapolis, Ind.

Mr. Miller told of the method of lagooning of poultry dressing wastes. Nitrate of soda (200 lbs.) was broadcast over the lagoon every 10 days in summer to offset septic conditions. The 27,900 gpd. of wastes entered the lagoon with a B.O.D. of 385 ppm. The lagoon effluent contained only 28 to 31 parts of B.O.D. and the process had been considered economical, practical and overall satisfactory. The B.O.D. load from the dressing plant averaged 5.6 lbs. for each 1000 pounds live weight of fowl killed.

Internal Reduction of Plant Wastes

"Waste Reduction by American Maize Products Co." was the subject of the "see what you can do" type of paper by G. H. McIntosh and E. M. Van Patten, Chemist and Bacteriologists, Am. Maize Products Co., Roby, Ind.

This inspirational contribution to literature on pollution abatement accomplishments will be printed in full in an early issue. We will, however, attempt to high light it here.

Mr. McIntosh presented the paper which revealed an orderly scientific attack in the internal revamping of plant processes and equipment plus the installation of triple effect evaporators and a special 3 man control laboratory at an overall cost of $850,000. But the net result had been a known waste elimination of $170,000 worth of marketable materials previously lost through leakage and wasteful procedures in plant operation. Overall a waste in B.O.D. values equivalent to 350,000 persons had been reduced to 28,000.

The program consisted of the following major steps:

(1) Maximum re-use of process waters and cendensates.
(2) Elimination of the all too convenient floor drains.
(3) Bottling up starch wash waters.
(4) The wide use of control equipment, including water meters to control water used in processing.
(5) Installation of most efficient known triple effect evaporators.
(6) Chlorination of all water used in plant operation.

Mr. McIntosh emphasized the great essentiality of an intra-mural educational campaign to make employees waste conscious and on the watch for leakages, spills, etc. which hitherto had been so handily flushed down the floor drains. Such improvements as the scheduling of starch washes to meet the water balance constituted but one example of process revamping. Holding tanks for starch filtrate and wash water, to be re-cycled, was another adjunct. All condensate water which previously ate into concrete sewers is now aerated in a tower and raised to pH 7 with lime before discharge to the Hammond municipal sewer.

Mr. McIntosh pointed out that regardless of all of the improvements and the wide use of control equipment to prevent manual failures, lagoons were being maintained "just in case."

Standards for Plant Effluents

"Standards for Waste Treatment Plant Effluents" was the subject of a comprehensive paper by F. B. Milliken, Division Engr., Penna. State Dept. of Health, Harrisburg, Pa.

Mr. Milliken who heads up the industrial waste section of the Pa. State Dept. presented a statistical paper which sets forth the minimum standards for effluent quality now existing in the various states and those adopted by water pollution compacts, river boards, commissions and other water quality control agencies.

Getting to the standards for effluent quality established to date by the Pa. Sanitary Water Board to cover municipal sewage and wastes of various industries, all sewage must receive the minimum of primary treatment (35% B.O.D. removal), an exception being those discharging into streams carrying acid mine drainage in quantity. Additional treatment is required wherever indications point to need for such. In establishing industrial waste standards industry committees participate. Finally, all plants in the particular industry in the state are given opportunity to pass opinions on proposed standards. To date 5 sets of effluent standards have been set up for various industries. These include pulp and paper, metal plating, milk plant and tannery wastes.

Mr. Milliken objected to the proposal by some that the assimilation capacity of streams be allocated to established plants and effluent standards be drawn to make full use of the waters of the stream involved. On the other hand he considers effluent

Speakers

S. R. Hoover
Chemist
U.S. Dept. Agri.
Philadelphia, Pa.

H. H. Webber
Director Expt. Sta.
Lowell Inst.
Lowell, Mass.

standards proper, if fitted to stream conditions. (Sounds to this interpreter as just another way of saying that effluent standards are logically subsidiary to stream standards as the *controlling* standard.—Ed.)

Strawboard Waste

"STRAWBOARD LAGOON OPERATION AT NOBLESVILLE, IND.," by Carl G. Krancher, Plant Manager, Ball Bros. Co., Noblesville, Ind.

Mr. Krancher reported that, to date, nothing better than lagoons had been proposed for strawboard wastes. At this plant five lagoons cover 47 acres, vary in depth from 5 to 25 ft. and hold 47 mil. cu. ft. of waste. Solids settle out and digest anaerobically. The settled waste is discharged to the White River at a dilution of no less than 1 to 350 parts of river water. Continuous river gage readings are taken and the discharge of waste carefully controlled to this dilution ratio. At this dilution, color and other effects on the river are not noticeable. Nor does such degree of pollution affect the treatment of the Indianapolis water supply taken a few miles down stream.

Irrigation for Canning Wastes

"DISPOSAL OF CANNERY WASTES BY IRRIGATION," by James C. Drake, Pub. Health Engr., and Fred K. Bieri, Chem. Engr., Minn. Dept. of Health, Minneapolis, Minn.

F. B. Milligan
Ind. Wastes Engr.
Pa. Dept. Health
Harrisburg, Pa.

G. H. McIntosh
Chemist
Am. Maize Prod. Co.
Roby, Ind.

Speakers

A year ago, Mr. Bieri reported on the effectiveness and the problems of lagooning. This year he reported on irrigation as a means of treating cannery wastes. Two methods are used; ridge and furrow and spraying; the latter has the advantage that the land can be cultivated. Applied at the rate of 117,000 gal. per acre per day, results were quite satisfactory, with no odors and no mosquitoes, but heavy weed growth particularly in the ridge and furrow system.

Fresh wastes must be used for spraying (anaerobic lagooned wastes are too odorous). The effect on crops was not determined. Naturally, better results are obtained in the more sandy soils, but tighter soils could be used if sufficient acreage was available.

No cost data compared to lagoons were available but the irrigation method appears to have several advantages. Effects on ground waters were not determined but might be a disadvantage of the method.

Magnesium Base Plant for Paper Wastes

"DEVELOPMENT OF MAGNESIUM BASE PLANT," by L. S. Wilcoxson, Vice-Pres., The Babcock and Wilcox Co., Alliance, Ohio.

At Longview, Wash., a sulfite pulp paper plant was converted to a Magnesium base plant after pilot experiments on the process. Using Magnesia and Sulfur dioxide it was found that the recovery was 78 per cent of the SO_2 and 88 per cent of the Mg. While far from perfect, this process materially cuts down the loss of waste from the pulping process. No cost figures were given, but operation is considered satisfactory.

Ed. Note: There being 54 papers presented in the three sessions running concurrently, and but two reporters to cover the three sessions, those papers considered of least interest to our readers were not covered. Therefore, any papers not dealt with in the three installments of this report are not oversights.

Chlorine-Dioxide Maligned

(A Correction)

In the second installment of our report covering the 6th Purdue Conference on Industrial Wastes, a digest of the report made by Messrs. Cleary and Kinney, covering the results from studies of the treatment of phenolic wastes, sponsored by The Ohio Valley Sanitation Commission, was given on page 237 of our May 1951 issue.

We have been advised of a serious error in the digest, which error reflects unfavorably on chlorine-dioxide as a practical oxidant for the destruction of phenols in by-product coke plant wastes. The statement concerning the efficiency of chlorine-dioxide in phenol destruction (also the combination of chlorine and chlorine-dioxide) includes reference to the 18-hour contact required as a disadvantage. We are advised that no part of the studies indicated that anything more than a 15 *minute* contact for complete reaction was required; and, most probably, considerably less contact time could have been proved adequate had sampling for less than the 15-minute contact been possible in the pilot plant studies. Laboratory studies indicated phenol destruction to be substantially complete in 5 minutes, or possibly less.

Concerning the remark in the digest; that, because of the high content of ammonia in the still waste straight chlorination (without chlorine-dioxide in combination) would prove excessively expensive, considering the necessity of reaching the "break-point" at 2000 parts of chlorine, or better, J. E. Kinney, San. Engr. of The Ohio Valley Commission, makes the following comment: "The ammonia concentration in the still waste can be controlled. It varies from 50 to 1500 ppm. For some phenolic wastes, chlorine alone may be the most feasible treatment, even though comparatively high dosages are required." Mr. Kinney went on to explain that, while the dosages in parts per million might be high the volume of still waste is relatively small and, consequently, the overall cost of treatment might not prove prohibitive.

We regret exceedingly our inadvertent malignment of the efficacious chlorine-dioxide. It all goes to prove the hazard of working from "cold notes," without the benefit of the author's manuscript for checking. We are sorry that we were advised of the error too late for this correction to be run in our June issue. The 18-hour contact disadvantage was in connection with the generally used Gibb's method of phenol determination which was supplemented by a much simpler method for plant control work.

Indianapolis Gets Rate Increase

Ordered to Fluoridate Supply

The Public Service Commission of Indiana granted a rate increase, recently, to the Indianapolis Water Co. The increase allowed a charge of $1.70 for the minimum charge for a ⅝-in. meter. The overall increase will bring the company approximately $1,000,000 more annually, but after taxes, the increased income to the company will only be approximately $500,000.

With this income assured, the company will go ahead with its multi-million dollar improvement program. A new filter plant is now going into service and additional storage reservoir facilities are under plan.

It is interesting to note that the PSC also ordered the Indianapolis Water Co. to institute fluoridation of the water supply. A study of this project will be made by the company in conjunction with the Indiana State Board of Health.

THE EDITOR'S COMMENTS

At Long-Last, A Claimant Agency

Victory for AWWA

At long-last, a Claimant Agency in Washington for water supply, sewage disposal and industrial waste treatment has become a reality. What's more important it is an agency all its own and is headed and staffed by men of experience in water supply and sewage disposal.

After many months of concerted endeavor (and what came to be such disheartening results) by a Special Committee representing the Am. Water Works Assn., the Sewage Works Federation, the Am. Public Health Assn. and the Water & Sewage Works Mfgrs. Assn. the ultimate victory came as the result of the pressure resorted to by the AWWA Board and prominent members ot the association during the 1951 Annual Convention in Miami. The effects of ground-work and continuous plugging by the Special Committee, involving a number of trips to Washington, and the urgent telegraphed appeals to Director Wilson of Defense Mobilization; Administrator Fleischmann of NPA; Administrator Wampler of Defense Production; Interior Secretary Chapman; the White House Office; the Director of the Budget; and, to many members of the Congress by individual members of AWWA during the Miami Convention, now spells VICTORY!

The process of employing political pressure by AWWA constituted something hitherto unused by the Association, but it is results that count and herewith is the effective telegram that put the ball over the goalline for the hard working, and all but completely discouraged, Special Committee.

> "The most critical question which is occupying the attention of the more than 2500 members of this Association who are attending the annual convention here is how long will the government in Washington continue to ignore our urgent need for a single claimant agency for municipal and industrial water supply and sewage and industrial waste disposal.
>
> As representatives of water works systems supplying water to a population of over 90 million people we again urgently ask that the interdepartmental controversies which are obstructing settlement of this issue be disposed of immediately so that the present chaos and confusion in our industry will be cured.
>
> We have been promised again and again by government officials that an effective claimant agency will be set up for our industry in the same way that the agency for the electric utilities was established, but so far there has been no definite action.
>
> We urge you to use your good offices to solve this problem and to advise us of what action is being taken prior to the conclusion of our meeting on May 4.
>
> AMERICAN WATER WORKS ASSOCIATION"

As a result of the barrage of these telegrams, before the closing of the Convention on May 4 word came by telegram to Miami which assured the prompt establishment of what has now been designated the Water Resources Division in NPA to serve as the single Claimant Agency "for municipal and industrial water supply and sewage and industrial waste disposal."

Concerning this long sought attainment, in our June issue we inserted a prominent "Late News" item in the first installment of the report covering the AWWA Convention, which confirmed the fact that a special Claimant Agency was in truth to be a reality, and no longer a "promissory note" which the Special Committee had about worn out carrying back and forth to Washington.

Loosing no time, on May 8 the Special Committee met with NPA Administrator Fleischmann in Washington, at his invitation, to develop an organization chart for the new Water Resources Division and to recommend a qualified person to head the Division. It appeared to the Committee that it was nothing more than a "natural" to name Harvey S. Howe, wheel-horse on the Committee who had served as Assistant Director of the Water Utilities Div. of the War Production Board during World War II, to head the Division. So, Harvey Howe, now Asst. Vice Pres., of Lock Joint Pipe Co., was for all practical purposes drafted for the job of at least organizing the new Division and getting the wheels rolling. The Lock Joint Pipe Co. bowed to the claims of the industry and NPA on the needed services and experience of Harvey Howe, and he is now at work assembling and cataloging materials requirement for the industry so that manufacturers will be allotted the necessary supply of critical materials under the Controlled Materials Plan (CMP) which became effective on July 1st.

For sometime, now, manufacturers of water and sewage works equipment have been in many instances illicitly using up critical materials from inventory in filling orders from water and sewage works managers without any assurance of replenishment. Although the new Water Resources Div. became a reality extremely late to get its requirements determined and filed under CMP for the third quarter of this year, Director Howe and staff are working long hours in an effort to put the water and sewage works industry on the map and secure the essentials for the third quarter of 1951.

We think that the members of the Special Committee, which made the frontal attack in behalf of the water and sewage works industry, at sacrifice of much time, effort, expense and patience, deserves a special vote of appreciation. They are H. E. Jordan (AWWA); Wm. J. Orchard (FSWA); Abel Wolman (APHA) and Harvey Howe (W&SWMA).

Special note should also be taken of the excursion of AWWA into the process of mass action in bringing political pressure to bear on Washington when something necessary needs be done, and the old "run-around game" has become no longer deceptive or endurable.

If the AWWA will spend more of its surplus in like operations, designed to secure for water supply the position deserved in the realm of public utilities, more power to it. The "screetching wheel" usually gets the grease and this instance further emphasizes the value of a "screetch" when logic and persuasion fail.

L. H. Enslow

Figure R 5556—Vertical Open Shaft Pump. For dry basin installations. Motor is mounted on floor above and connected to the Pump through shaft with Universal flexible couplings. See Bulletin 126.

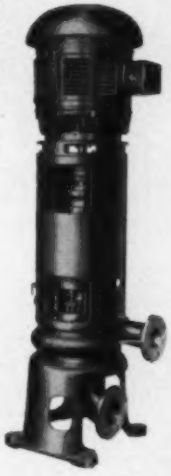


Figure R 5656—Vertical Pedestal Mounted Non-Clog Pump. See Bulletin 126.

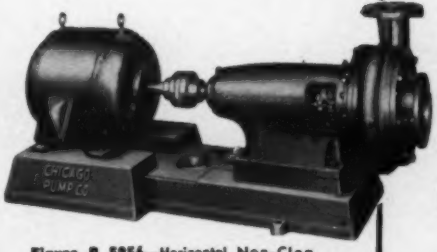


Figure R 5856—Horizontal Non-Clog Pump with direct electric motor drive. Described in Bulletin 127.

for LONGER LIFE . . .
for TIME and LABOR SAVING
SEWAGE SERVICE

Specify

CHICAGO NON-CLOGGING PUMPS

There is a "Chicago" Pump for every sewage and waste disposal need. To specify "Chicago" Sewage Pumps assures a unit that is specifically designed and engineered for the job. Long life, low maintenance cost, trouble-free service . . . these advantages are built in with every "Chicago" Pump.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Valves. Screw-Pattern. Plungers. Horizontal and Vertical Non-Clogs Water Seal Pumping Units. Samplers.

Swing Diffusers. Stationary Diffusers. Mechanical Aerators. Combination Aerator-Clarifiers. Comminutors.

Meetings Scheduled:

Aug. 20-22—Toronto, Ont. *(Royal York Hotel)*
CANADIAN INSTITUTE ON SEWAGE & SANITATION. Sec'y, A. E. Berry, Parliament Buildings, Toronto, Ont.

Aug. 20-22—State College *(Nittany Lion Inn)*
PENNSYLVANIA WATER WORKS OPERATORS' ASSOCIATION. Sec'y, R. Rupert Kountz, Penna. State College, State College, Pa.

Aug. 22-24—State College *(Nittany Lion Inn)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 10-12—Boston, Mass. *(Hotel Statler)* NEW ENGLAND WATER WORKS ASSOCIATION (Annual convention). Sec'y, Jos. C. Knox, 73 Trement Street, Boston 8, Mass.

Sept. 11-13—Marshalltown, Iowa *(Hotel Tall Corn)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtcamp, P.O. Box 310, Webster City, Ia.

Sept. 12-14—Minneapolis, Minn. *(Hotel Nicollet)*
MINNESOTA SECTION A.W.W.A. Sec'y, Leonard N. Thompson, 216 Court House Bldg., St. Paul, Minn.

Sept. 13-14—Whiteface, N.Y. *(Whiteface Inn on Lake Placid)* NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York 20, N.Y.

Sept. 16-19—Detroit, Mich. *(Veterans Memorial Bldg.)*
AMERICAN PUBLIC WORKS ASSOCIATION. (Annual Convention). Director, D. F. Herrick, 1313 East 60th St., Chicago, Ill.

Sept. 17-19—Louisville, Ky. *(Kentucky Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. and KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORK ASSN.
Sec'y, R. P. Farrell, 420 Sixth Ave., N., Nashville 3, Tenn.

WATER LEVEL CONTROL

Never Sleeps
Never Forgets

Maintains exact levels to 1/100 of an inch in **Water Tanks—Reservoirs—Settling Basins—Boilers—**

Lumenite Electronic
LIQUID LEVEL CONTROL

To Pump Motor, Motorized Valves, Solenoid Valves, Etc.

Has **no moving parts**—no **floats**—Operates electronically with 1/10000 Amp. impulse. Just two steel rods in container—nothing else. Controls directly pump motors, motorized valves. Simple installation. Practically no up-keep.

Write for Engineering bulletin No. 421

Lumenite Electronic Company
ENGINEERS DESIGNERS MANUFACTURERS
407 S. Dearborn Street Chicago 5, Ill

Sept. 19-21—St. Joseph, Mich. *(Whitcomb Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, 2609 E. Saginaw Street, Lansing 12, Mich.

Sept. 19-21—Atlanta, Ga. *(Georgia Institute of Technology)*
GEORGIA WATER & SEWAGE ASSOCIATION. Sec'y, A. T. Storey, 1210 Hempkill Ave., N.W., Atlanta, Ga.

Sept. 19-21—Yankton, S. Dak. *(Charles Gurney Hotel)*
SOUTH DAKOTA SECTION A.W.W.A. and SOUTH DAKOTA SEWAGE WORKS ASSOCIATION. Sec'y, Chas. E. Carl, State Board of Health, Pierre, S. Dak.

Sept. 19-21—Philadelphia, Pa. *(Stratford Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, Dept. of Health, Greensburg, Pa.

Sept. 24-25—Denver, Colo. *(Cosmopolitan Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, P.O. Box 600, Denver, Colo.

Sept. 26—Denver, Colo. *(Cosmopolitan Hotel)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, Carrol H. Coberly, 1441 Welton St., Denver, Colo.

Sept. 24-26—Biloxi, Miss. *(Buena Vista Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Chas. W. White, 519 Dexter Ave., Montgomery, Ala.

Sept. 25-27—Milwaukee, Wis. *(Hotel Pfister)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

Sept. 26-28—Fargo, N.D. *(Gardner Hotel)*
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Jerome H. Svore, State Dept. of Health, Bismarck, N.D.

Sept. 27-28—Saskatoon, Sask. *(Bessborough Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. Sec'y, H. C. Lindsten, 301 Hamilton Bldg., Winnipeg, Can.

Sept. 27-28—Toledo, Ohio *(Commodore Perry Hotel)*
OHIO SECTION A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

Sept. 30-Oct. 2—St. Joseph, Mo. *(Robidoux Hotel)*
MISSOURI SECTION A.W.W.A. MISSOURI WATER & SEWAGE CONFERENCE. Sec'y, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

Oct. 3-4—Charleston, W. Va. *(Daniel Boone Hotel)*
WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Glen O. Fortney, State Health Department, Charleston, W. Va.

Oct. 4-5—Charleston, W. Va. *(Daniel Boone Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, H. K. Gidley, State Department of Health, Charleston 5, W. Va.

Oct. 8-11—St. Paul, Minn. *(Municipal Auditorium)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN'S. (Annual Convention) W. H. Wisely, 325 Illinois Building, Champaign, Ill.

Oct. 14-17—Fort Worth, Texas *(Hotel Texas)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Memorial Auditorium, Little Rock, Ark.

Oct. 18-20—Corpus Christi, Texas
NATIONAL ASSOCIATION OF CORROSION ENGINEERS. (South Central Region.) Sec'y, A. B. Campbell, 919 Milam Building, Houston, Tex.

Oct. 22-25—New York, N.Y.
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Annual Meeting). Sec'y, William N. Carey, 33 West 39th St., New York 18, N.Y.

Oct. 23-26—Atlantic City, N.J. *(Hotel Claridge)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 23-26—San Francisco, Calif. *(Fairmont Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, Wm. W. Aultman, Box 38, LaVerne, Calif.

Oct. 25-27—Dubuque, Iowa *(Hotel Julian)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 25-27—Atlantic City, N.J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

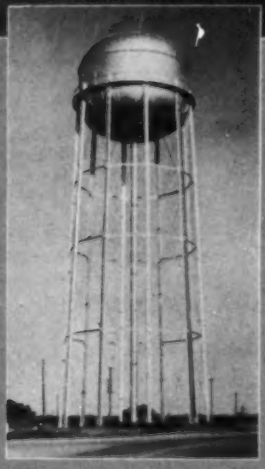
Oct. 28-31—Daytona Beach, Fla. *(Princess Issena Hotel)*
FLORIDA SECTION A.W.W.A. (Joint Meeting)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Perry M. Teeple, P.O. Box 210, Jacksonville, Fla.

Oct. 29-Nov. 2—San Francisco, Calif. *(Civic Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION. (Annual Meeting) Sec'y, Mrs. W. R. Walsh, 1790 Broadway, New York. N.Y.

PITTSBURGH • DES MOINES

Stands for

BETTER WATER SERVICE *with* ELEVATED STEEL TANKS



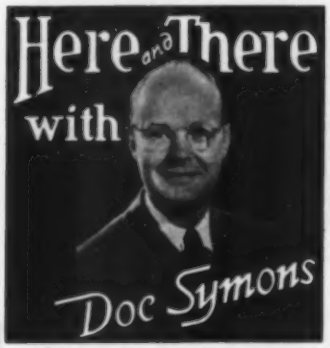
Ample supply for peak demands—dependable, uniform pressures—reserve capacity for fire protection and pump interruptions . . . these and every other feature of desirable water service are gained through the right Pittsburgh-Des Moines Elevated Steel Tank for specific community needs. Determination of correct tank type and size is simplified by a consultation with experienced P-DM engineers. *Let us cooperate!*

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25), . . . 3418 Neville Island
NEW YORK (7), . . Room 918, 270 Broadway
CHICAGO (3), 1222 First National Bank Bldg.
DES MOINES (8), ... 910 Tuttle Street
DALLAS (1), . . . 1223 Praetorian Building
SEATTLE . . . . . 926 Lane Street
SANTA CLARA, CAL. . . 625 Alviso Road



H.T.M.A.—And I don't have to tell you that this column is going to be about the AWWA Convention in Miami and my sojourn in Florida. Little more than a month ago, I left you with the sound in my ears, of a gasoline driven pump emptying a septic tank at beautiful Lake Worth, Fla. And now, the convention has come and gone, reports have been written, the echoes of the last goodbyes have died away, and that chapter is closed.

* * *

Have you ever been so filled with memories that you find only a kaleidoscopic jumble as you try to recall scenes to those who shared your experiences or, to paint a word picture for those who did not. That is I, at the moment. It's hard to unscramble the mental picture of the rolling waves of the ocean, the palm trees, the strange flowers, cocktail parties, technical sessions, dances, awards, room hopping, old friends, new acquaintances, delectable meals, old and new hotels, transportation, exhibits, people, places, and things.

* * *

It was all new to me: The drive down the coast on Florida Route A1A from fabulous Palm Beach through Delray, Boca Raton, and the lovely venetian canals of Ft. Lauderdale to the equally fabulous Miami Beach, with its towering hotels stretching for miles along the ocean, across the MacArthur Causeway and to Miami. How different from the "great corn desert" of Illinois, the lake dotted Wisconsin, the roar of Niagara Falls, the Finger Lakes of New York State, the quaint houses and quiet back roads of Connecticut, the wonderful hills of Westchester County, and the gasoline fume laden "ulcer" canyons of Manhattan.—Yes, how different; I hadn't been there too long, before I had "sand in my shoes" and I commissioned Fred (The Senator) Eidsness and Dave (Health Dept.) Lee to get me a job as operations consultant of the forthcoming Palm Beach Sewage District.—I could gladly spend the long winters down there soaking up the sun, enjoying the water, playing golf, etc., etc., etc.

* * *

The convention, as you well know, was held in Dinner Key Auditorium, a converted hanger of the Pan American Airways, when it used flying boats on its route to South America. Dinner Key, which is five miles out from the location of the hotels, is no longer a Key (small island). The water that once separated this tiny spot from the mainland has long since been filled in, and the origin of the name is now rather clouded. I checked with the City Desk of the Miami Herald and learned that "it is probably so called because it was once a dinner stop on the boat trip from Miami to Key West. Mary Rodgers (Harry Jordan's secretary) tells me, however, that over the radio she heard a quiz show contestant give the answer that Dinner Key used to be a small Key where Miamians and their families went for Sunday picnics.—Take your choice.

(*Continued on page* 88A)

Pitt Chem Protective Coatings guard your equipment with a tough, surface-protecting film . . . an impervious sheath against strong chemicals, high temperatures, atmospheric exposure and other destructive elements of industrial corrosion and contamination. *Pitt Chem* Coatings are completely uniform and dependable because they are laboratory-controlled from raw materials to finished product. You'll find the cost of safeguarding your equipment with *Pitt Chem* is surprisingly low. ● For more information, write for new booklet, "Control Corrosion Through Pitt Chem Protective Coatings."

★ Hot Applied Tar Base Coatings ★ Cold Applied Tar Base Coatings ★ Alkyd Base Coatings
★ Chlorinated Rubber Base Coatings ★ Vinyl Base Coatings ★ Phenolic Base Coatings

Protective Coatings Division

PITTSBURGH
COKE & CHEMICAL CO.

W&D 3726

GRANT BUILDING, PITTSBURGH 19, PA.

OFFICES: NEW YORK • CHICAGO • ST. LOUIS • TULSA • HOUSTON • LOS ANGELES • SAN FRANCISCO

Extending a water main system?

"Century"®

ASBESTOS-CEMENT PRESSURE PIPE

keeps installation costs low....
gives permanent, trouble-free service!

In extending water mains, or when installing a new system, *installation costs* are often a major part of the original investment. But you can make important savings on installation costs—keep your original investment to a minimum—with "Century" Asbestos-Cement Pressure Pipe.

"Century" Pressure Pipe is moderate in price—you save right from the start! It's strong and durable ... but light in weight and easy to handle ... can be laid quickly—you make further savings on installation. Connection to existing mains, fittings, hydrants, and valves presents no problem.

Non-metallic "Century" Pipe cannot rust or corrode and since tuberculation is impossible, inside diameter, flow capacity and pumping costs are unaffected. Thus savings continue over the years!

Before you buy or specify any pipe for water mains, it will pay you to investigate the cost-saving advantages of "Century" Asbestos-Cement Pressure Pipe. Write us for complete information.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

"Century" Pipe being laid as extension to serve new development. "Century" Simplex Couplings supplied with "Century" Pressure Pipe facilitate rapid laying of straight runs or curves up to 5° deflection per pipe length.

"Century" Pipe is made in two pressure classes: 100 and 150 pounds per square inch. Every section is hydrostatically tested to insure ample reserve to handle normal "water hammer."

K&M Asbestos Rope for yarning bell and spigot joints reduces the hazard of bacterial content following the laying of mains. Write for details.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

(*Continued from page* 86A)

Among the many exhibits, some elaborate, some large, and some small, all informative, was the booth of *Water & Sewage Works*, with a beautiful large reproduction of the front cover of the April issue, hanging on the back drop. — Allan Wymore, Cons. Engr., of the firm of Burns and McDonnell, Kansas City, sent word from K.C. by—(Oh Lord, I've forgotten who it was) that we needed a good razzing about the lovely (?) pink color of that April front cover.—That's *W & S W* for you—always attracts attention!

And speaking of *W & S W*, one of the highlights of my visit to the convention was meeting Mr. H. P. Gillette, President and Founder of *Water & Sewage Works*. In the eight years that I have been writing this column, our paths have never crossed before, he residing in California and I on the other coast.

I know now that the nickname "*Horsepower*" comes from more than just the initials "HP."—You'd never believe he has passed four score years.—Charming wife, too.—I discovered that he reads my stuff, and as a reader, too, not as company president. Pleased me, no end.

"H.P." is an authority, you know, on weather cycles and long range rainfall forecasting. I got a kick out of the story that when New York City was feverishly looking for water during the drouth a year or so ago and began to build a pumping station on the Hudson River, Enslow asked him if New York would need it. He predicted that by the time it was built, there would be plenty of rain and water.—He was right, too. —P.S. Fearful that the reputation of our long range weather forecasting prexy might suffer—what with New York's reservoirs 70 per cent depleted at the time—Linn admits that he was a little afraid to print the story.

* * *

Entertainment at the convention included everything from the Choral Belles, a dinner dance, variety show, and room hopping for refreshments, to some delightful cocktail parties and an impromptu fish fry. A couple of fellows, named Bowers and Horlacher, Cleveland agents for B-I-F Industries (Builders, Props, and Omega) went deep sea fishing. Result—fish fry. It was such a success that I have predicted that next year in Kansas City, there will be another.

* * *

Of course, you know, that the Society of Council Bluffers held its annual session at midnight, after the dinner dance, meeting, according to the by-laws in the suite of Dan (Permutit) and "Lil" Saunders. Sam (Elizabeth, N.J.) Newkirk was elected President for '51-'52, although he wasn't there. There isn't space to tell that story this month, and it will have to go over to the next issue. Right now there's a couple of items leftover that didn't get into the last column.

* * *

When it came to food, everyone was talking about sea food, pompano, fresh shrimp from the Keys, unusual fruits such as papaya and mangos—and Key Lime Pie. Key Limes are different from the ordinary lime. The tree is thorny, the limes are larger and they come from

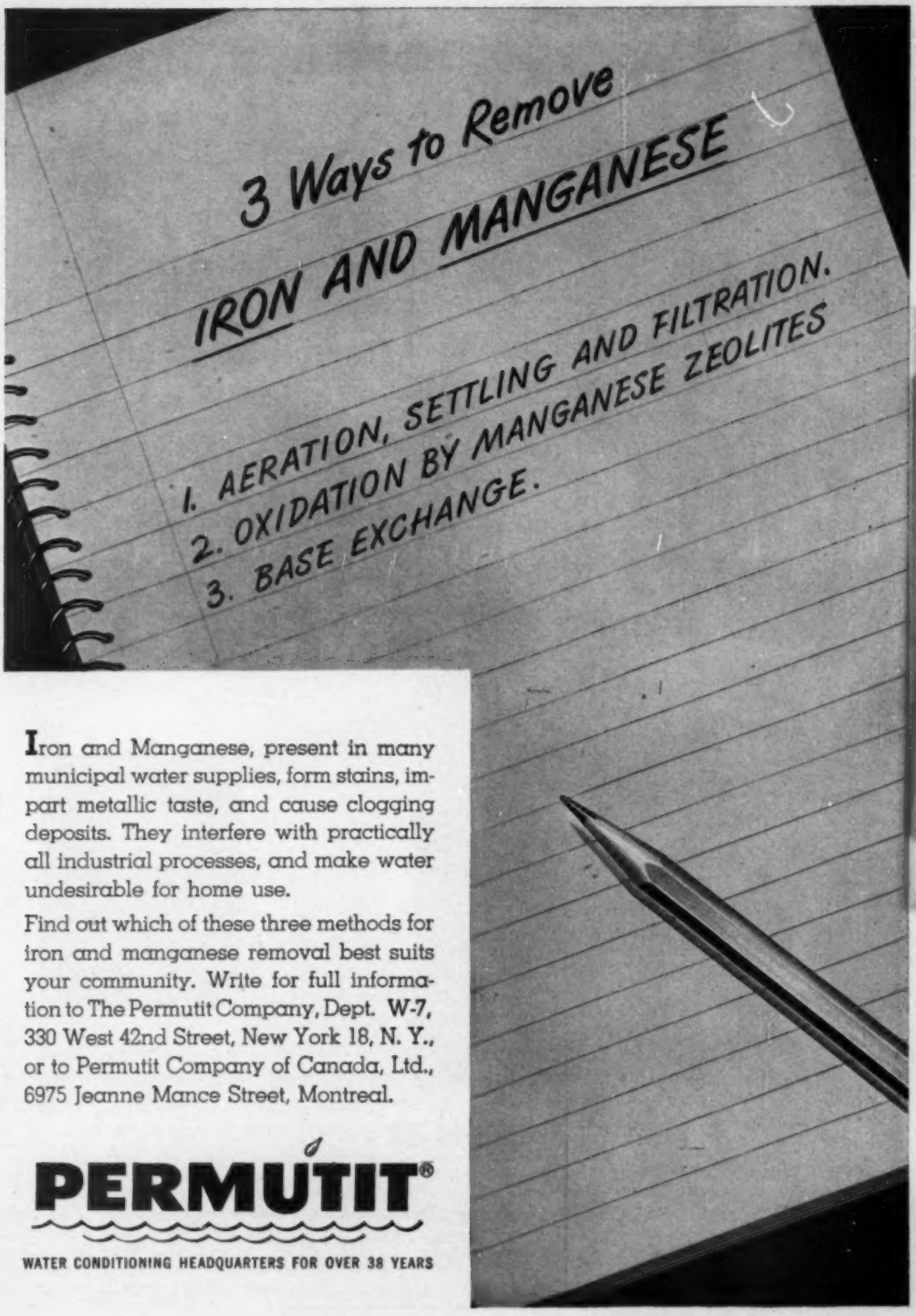
(*Continued on page* 90A)

It may be a far cry from sow's ears to a %Proportioneers% Heavy Duty Duplex Chem-O-Feeder, but you don't have to travel far to find one in action — performing its job easily, efficiently, accurately. There are over 35,000 %Proportioneers% installations . . . each one a good reason why it pays to use %Proportioneers% water treating and purifying equipment. Mail coupon or write today for data and recommendations.

%Proportioneers, Inc.%
350 Harris Ave.
Providence 1, R. I.
Please send Bulletin SAN-7

Name .....
Company .....
Street .....
City ..... State .....

Answers: 1. Rabbit Ears 2. Corn Ears 3. Sow's Ears
4. % PROPORTIONEERS, INC. %


3 Ways to Remove
IRON AND MANGANESE
1. AERATION, SETTLING AND FILTRATION.
2. OXIDATION BY MANGANESE ZEOLITES
3. BASE EXCHANGE.

Iron and Manganese, present in many municipal water supplies, form stains, impart metallic taste, and cause clogging deposits. They interfere with practically all industrial processes, and make water undesirable for home use.

Find out which of these three methods for iron and manganese removal best suits your community. Write for full information to The Permutit Company, Dept. W-7, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

PERMUTIT®

WATER CONDITIONING HEADQUARTERS FOR OVER 38 YEARS

(*Continued from page* 88A)

one of the Keys (although they are raised elsewhere in Fla.) Key Lime Pie is to that section of Florida what Sweet Potato Pie is to many sections of other southern states. For those of you who are interested, here is the recipe:

"Combine four egg yolks, three ounces of Key Lime Juice, and one can of condensed milk. Pour into baked pie crust and add meringue top. Bake until meringue is brown." —It's delicious.

* * *

I can't resist telling you this story —Carl Brown and Les Hart, those two snappy dressers of U.S. Pipe and Foundry Co., had a complaint. They said, "It's all right for Miami to go all out in honoring the president of the Manufacturers' Assn., Johns-Manville's "Bob" Orth, but isn't it overdoing it a bit to put "Transite" pipe around the trunks of all the palm trees"—(Now that Carl is Vice President-Elect of the Manufacturers Assn. I'm waiting to see some cast iron tree trunks a couple of years from now.)

Seriously, they were referring, of course, to the stately Royal Palms, whose smooth trunks do look like "Transite" pipe, as they rise high into the air, to be topped by a distinctive arrangement of branches and leaves, looking like a shower of streaming sparks from a skyrocket bursting in the sky.

Unfortunately, my pictures of the Royal Palms, were not quite as successful as the shots shown above, but here's a silhouette of the ubiquitous cocanut tree.

* * *

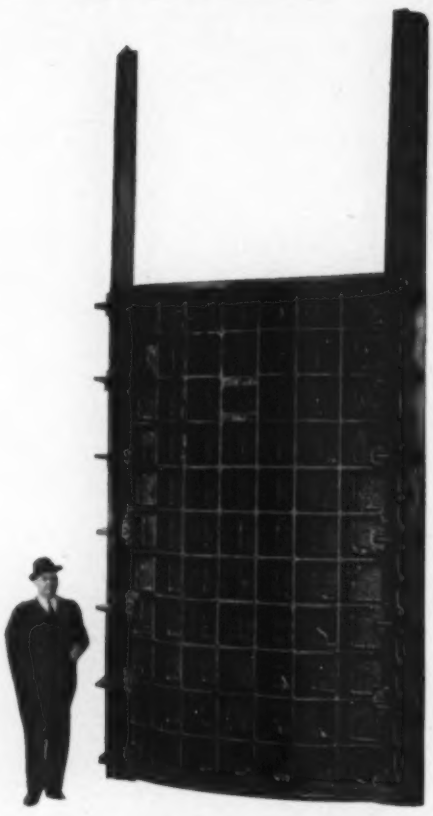
Besides the stretches of beach, the rolling waves breaking on the sand, the beautiful blue water, the fragrant and luscious flowers with the unspellable, if not unpronounceable, names and the food to delight the gourmet, there were other delightful and gorgeous sights to behold. One of them could be seen at the Orange Juice Bar run by the Florida Section of AWWA on the Exhibit Floor.

I give you here, "Bobby Jo" Hood, from the campus of the University of Florida, at Gainesville, Fla.— That reminds me, I must drop in to see Doc Black, Johnny Kiker, and Fred Eidnsess down there.

* * *

Well, here it is—once again I've run out of time. Oh, I haven't forgotten that last month I promised you a story about Earnest Boyce, but it can wait. And then there's more impressions of Lake Worth and the surrounding country, a picture of a

(*Continued on page* 92A)



FILER & STOWELL SLUICE GATES

are built to stand long trouble free service. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY
MILWAUKEE 7, WISC.

Hartford's famous Charter Oak which flourished for 200 years before it fell in 1856

Hartford, Connecticut, has a cast iron gas main in service that was installed more than a century ago. On the anniversary of its 100th service year a section of this main was uncovered for inspection and found to be in excellent condition. This main, installed in the days of horse-drawn vans and vehicles, is now serving under the pavement of one of Hartford's principal thoroughfares and withstanding the traffic shock imposed by modern buses and multi-ton trucks. Despite such unforeseen stresses, cast iron water and gas mains, installed over a century ago, are still serving in the streets of more than 30 cities in the United States and Canada.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S.
cast iron
PIPE

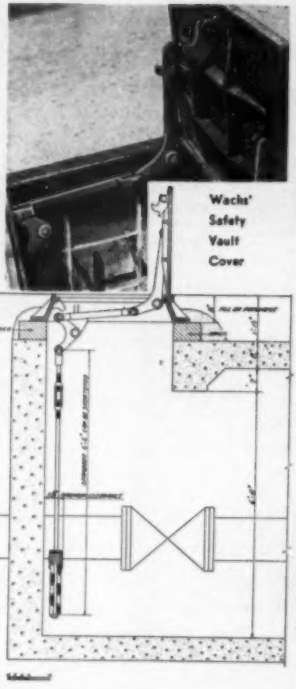
NUMBER SEVEN OF A SERIES

(*Continued from page* 90A)

banyan tree, "what is a banyan tree," more stories about the convention, a recount of our trip to Key West, a tale about Dick Hazen and "Tony" (Infilco) Kalinske, an item on Ray (AWWA) Faust, and a story about Paul Weir, plus a dozen other assorted items from Miami and elsewhere. So — That's all for this stanza—

V.T.Y.—Doc

Manufacturers' and Equipment News



Wachs' Safety Vault Cover

Safety Manhole and Vault Cover

701

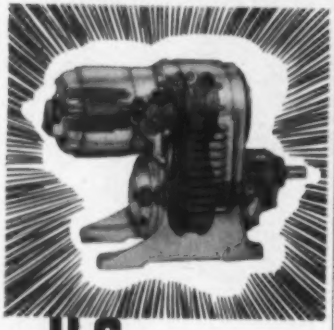
E. H. Wachs Co., Chicago, Ill., has developed a Safety Manhole Cover for valve, meter, transformer and district governor vaults.

This Wachs Safety Counterbalanced Manhole Cover can be opened with ease and safety by one man. To open, the combination key-handle is inserted and given a half

(*Continued on page* 94A)

Miracle MOTOR

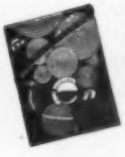
STEPS UP MACHINE OUTPUT



U.S. VARIDRIVE MOTOR

INCREASES PRODUCTION 10% — 20% — 30% OR MORE

Varidrive will give your powered equipment any and every speed needed right up or down to a split rpm. No external gearing. Simply turn the control handle for instant speed selection. Speed can be regulated to compensate for variation in operator's ability — or to obtain correct rhythm of movement. Varidrive speeds compensate for changes in viscosity, temperature, line-flow or size of work handled. You get maximum output and better quality.



2 TO 10,000 RPM

"As slow as a snail or fast as a flash," or any in-between speed, enables you to get miracle performance out of your machines with Varidrive. Select speed ranges up to 10:1 variation. Sizes... ¼ to 50 hp.

GET BULLETIN

Interesting Bulletin full of facts proving big savings you can make with Varidrive.

U.S. MOTORS

U. S. Electrical Motors, Inc. WSW-7
200 E. Slauson Ave., Los Angeles 54, Calif.
or Milford, Conn.

Send Varidrive Bulletin

Name_____

Company_____

Address_____

City Zone State

LEADITE

The Pioneer Self Caulking Material for C. I. Pipe

Thousands of miles are—

Jointed with LEADITE for Satisfaction and Long Life

because Leadite makes a good, tight joint that improves with age . . . and in addition, saves on installation costs.

Write for Literature.

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

FOR BETTER pH Control and WATER TESTS

there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of technique, and compactness of the apparatus are exclusive features of Hellige Comparators.

Write for NEW Catalog No. 600-10

HELLIGE

INCORPORATED

3718 NORTHERN BLVD. LONG ISLAND CITY I, N.Y.

HEADQUARTERS FOR COLORIMETRIC APPARATUS

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

The valve that's

forever seated

A PERFECT APPLICATION FOR SEWAGE DISPOSAL SERVICES

LUBRICATED — *external repressuring screw*

AUTOMATIC LUBRICATION WITH HYPERMATIC

EASY OPERATION — *quarter-turn to close*

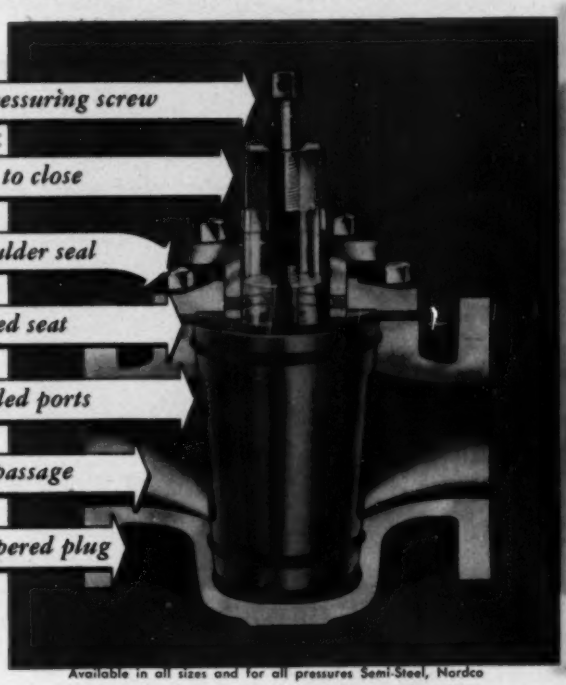
ANTI-FRICTION — *resilient shoulder seal*

UNEXPOSED — *fully-protected seat*

NON-LEAKING — *lubricant-sealed ports*

FLUSH WALLS — *streamlined passage*

NON-STICKING — *full-seated tapered plug*



Conventional valves have to unseat to open. Nordstrom valves never unseat. The plug turns on an unexposed seat. Abrasives cannot intrude to cut the seat. Result? Longest life. Positive closure.

Available in all sizes and for all pressures Semi-Steel, Nordco Steel, Stainless Steel, bronze and Special alloys. Ask for Bulletin.

Nordstrom Valves

NOW AUTOMATICALLY LUBRICATED WITH Pats. Applied for **Hypermatic** Trade Mark

ROCKWELL MANUFACTURING CO.

400 North Lexington Avenue, Pittsburgh 8, Pa. Offices in all principal cities

Export — Rockwell Mfg. Co., International Division, Empire State Building, New York 1

(*Continued from page 92A*)

turn and the cover opens with one hand. The counterbalance weights that make lifting the cover a one handed job also holds it in an upright, protective position while a man is below.

According to the company, this cover was designed and manufactured to withstand the heaviest traffic, provides an unobstructed 30 inch square opening, and complete counterbalance structure protrudes less than 6 inches from the wall. The company will cast custom lettering on the cover on special order.

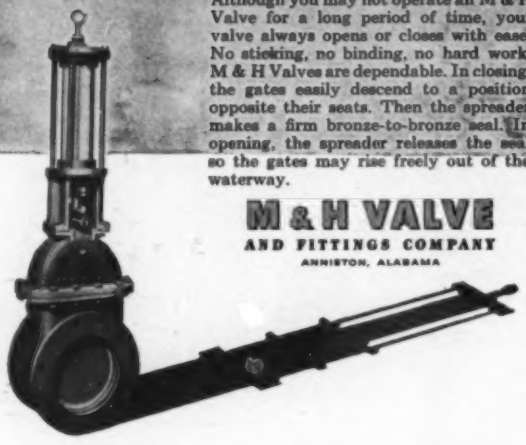
Boncher Elected V. P. of Dresser

Dresser Industries, Inc., Bradford, Pa., has elected H. P. Boncher as Vice President of the company. The announcement was made by H. N. Mallon, President, at a board meeting of Dresser Industries at Dallas, Texas, recently.

Mr. Boncher joined Dresser shortly after graduation from the University of Cincinnati. He was appointed Assistant Sales Manager in 1930, promoted to Sales Manager in 1938 and to his present position as General Manager of Dresser Manufacturing Division (couplings, etc.) in 1942.

Other officers of Dresser Industries elected were: H. N. Mallon, President; J. B. O'Connor, Executive Vice President; Arthur R. Weiss, Vice President; and M. H. Nelson, Assistant Secretary and Assistant Treasurer.

DEPENDABLE
AS THE SUNRISE



Although you may not operate an M & H Valve for a long period of time, your valve always opens or closes with ease. No sticking, no binding, no hard work. M & H Valves are dependable. In closing, the gates easily descend to a position opposite their seats. Then the spreader makes a firm bronze-to-bronze seal. In opening, the spreader releases the seal so the gates may rise freely out of the waterway.

M & H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

M & H Skeleton type brass cylinder Hydraulic Valve.

DAY OR NIGHT
WINTER OR SUMMER
YEAR AFTER YEAR

Users report that M & H Valves seldom need repairs or new parts. Rugged in construction, dependable in operation, M & H Valves are designed for uninterrupted service winter or summer, year after year. Sizes 2 to 30 inches; manual, hydraulic or motor operated M & H Valves are available with or without square bottom.

COMPLETE INFORMATION ON REQUEST

M&H PRODUCTS Everywhere

Cut-In Valve and Sleeve

702

A. P. Smith Mfg. Co., East Orange, N.J., has developed a mechanical joint cut-in valve and sleeve.

According to the company, all that is necessary to install the new cut-in valve and sleeve is a ratchet and open end wrench, three rubber gaskets, three cast iron follower rings and a handful of bolts and nuts.

The valve is supplied in 3, 4, 6, 8, 10, and 12 inch sizes, with larger sizes available on special request and is designed to conform with AWWA specifications.

"Rod" Reed, Exec. Vice-Pres. of New Advertising Firm

A new advertising agency, Marstellar, Gebhardt & Reed, Inc., Chicago, Ill., was formed in May, this year. The agency combines the 33-year-old Chicago agency of Gebhardt & Brockson, Inc., and the Pittsburgh office of the McCarty Company.

The new company is headed by E. A. Gebhardt, Chairman of the Board;

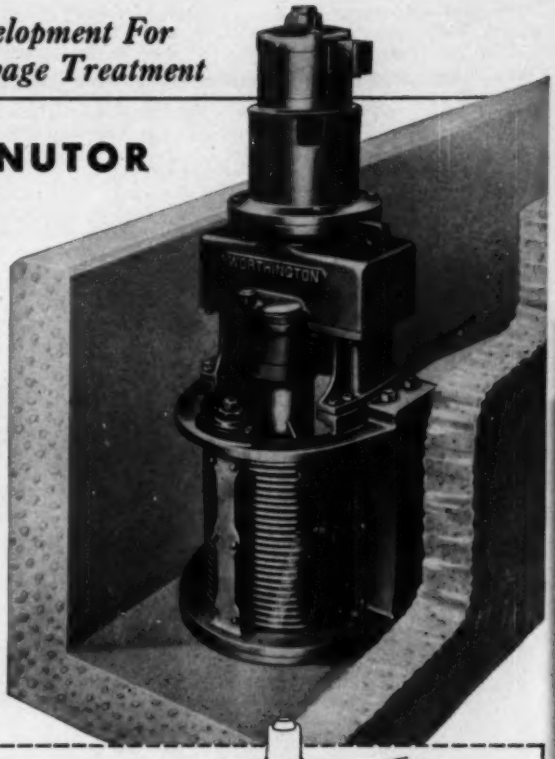
(*Continued on page 96A*)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

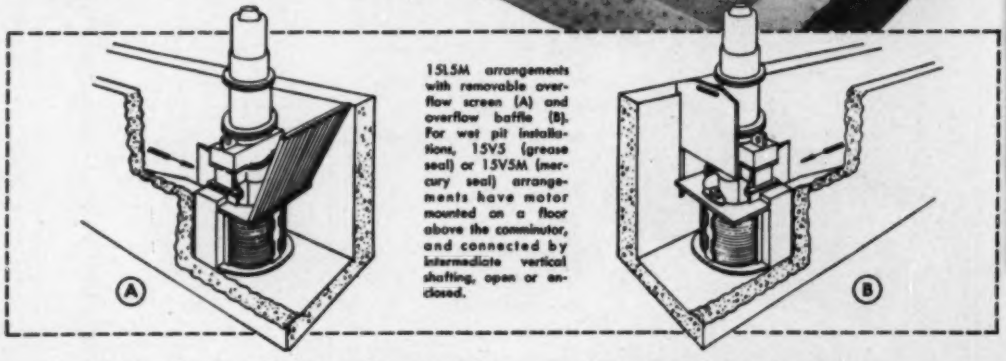
Another Worthington Development For Time- and Labor-Saving Sewage Treatment

THE ONLY COMMINUTOR WITH ALL THESE ADVANTAGES...

- **Easy installation in straight-flow rectangular sewage channels, new or old.**
- **Cutter racks quickly removable for sharpening or replacement, eliminating tedious individual cutter sharpening and adjusting.**
- **Provision for a mercury seal, for automatic protection of internal parts at unusually deep submergences. (Grease seal furnished as standard equipment.)**
- **Provision for overflow screen or baffle by means of a supporting flange.**



The 15C5 Worthington comminutor arrangement for continuous, automatic sewage solids cutting. This unit is designed for a .3 to 2.3 mgd flow range in a channel of 3 feet maximum depth. Standard grease seal supplied is suitable for water depths up to 22 inches. ➔



15L5M arrangements with removable overflow screen (A) and overflow baffle (B). For wet pit installations, 15V5 (grease seal) or 15V5M (mercury seal) arrangements have motor mounted on a floor above the comminutor, and connected by intermediate vertical shafting, open or enclosed.

In many installations infiltration subjects comminutors to peak flows and submergences beyond their maximum capacities. Only Worthington comminutors can be supplied with both a mercury seal and an overflow screen or baffle to handle this problem.

The mercury seal automatically protects the unit's internal parts up to a reasonable submergence. The gear head motor is mounted on a motor base extension pipe above high water level; channel depth may be over 3 feet. The removable overflow screen provides screening at the comminutor's overflow without causing troublesome upstream conditions, and occasional accumulations may be raked down into the unit. Or, an overflow baffle may be used to back the sewage up through the by-pass screen, preventing overflow.

Many Other Advantages

of the Worthington comminutor combine for rapid, continuous, automatic comminution — and for the long, trouble-free service life that proves *there's more worth in Worthington.* Write for bulletin W-2010-B3, and for drawings of arrangements best suited to your own application. Or contact our nearest District Office. *Worthington Pump and Machinery Corporation, Harrison, N. J.*

WORTHINGTON

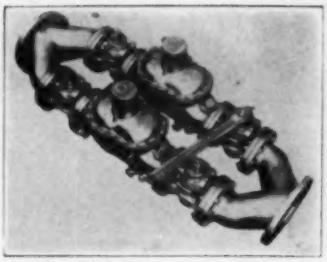
(Continued from page 94A)

Wm. A. Marsteller, President, and R. S. Reed, Jr., Executive Vice President and manager of the Pittsburgh office.

Mr. Gebhardt, former president of Gebhardt & Brockson, is a veteran Chicago agency man. Mr. Marsteller was vice president in charge of advertising and market research of the Rockwell Manufacturing Co., Pittsburgh.

Mr. Reed, a native of Cortland, N.Y., has been vice president and eastern manager of The McCarty Co. since it opened a Pittsburgh office in 1944. A graduate of Brown University with a C.E. degree, for a number of years he was advertising manager for the Pittsburgh Equitable Meters Co., prior to taking charge of the Pittsburgh office of The McCarty Co., and has long been a member of the Industrial Marketing Council of Pittsburgh.

Marsteller, Gebhardt & Reed, Inc., which handles a number of advertising accounts in the water, sewage and industrial waste fields, maintain offices at 600 South Michigan Avenue, Chicago, and at 600 Grant Street, Pittsburgh.



Compound Meter Manifold Unit

703

Rockwell Manufacturing Co., Pittsburgh, Pa., has introduced a new compound meter manifold unit.

The manifold assembly consists of two Pittsburgh-Empire single register compound meters in combination with four Nordstrom lubricated plug valves and two 8-inch reducing manifolds, so arranged that for maintenance, one side may be shut down at a time without complete interruption of service.

By isolating one side, a meter can be removed and exchanged for one serviced and calibrated in the shop, while flow continues through the other meter passage. It is also possible, with this assembly, to check-test a meter in place without a break in service.

The manifold assembly has the same flow capacity—1,600 G.P.M. —as the AWWA requirements for an 8-inch compound meter. As a unit, it has a laying length that is within the AWWA standard for a single 8-inch compound meter. Sold as a unit, it is priced below a single 8-inch compound meter, and the complete manifold of meters, valves and piping weighs 100 lbs. less than a comparable 8-inch compound meter.

Rockwell Appoints Burnette Service Manager

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced the appointment of R. V. Burnette as Service Manager for the Company's Meter and Valve Division. A. J. Kerr, VP of Sales stated that Burnette's duties will also consist of establishing repair procedures in factories and district warehouses.

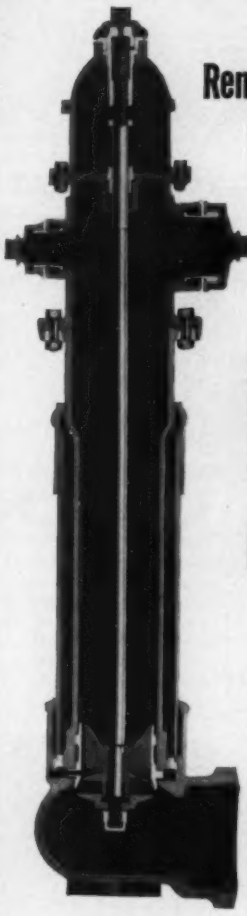
Mr. Burnette was affiliated with Standard Steel Car Co., in Sharon, Penna. before joining the Pittsburgh Equitable Meter Co., in 1926.

Thomas Elected President of Monsanto

Monsanto Chemical Co., St. Louis, Missouri, has announced the election

(Continued on page 98A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.



Removable barrel contains all working parts

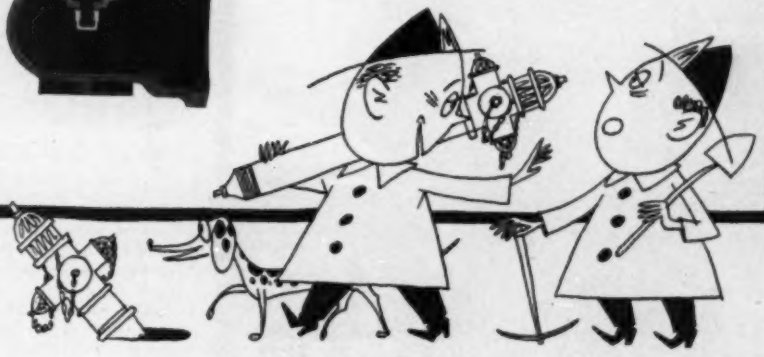
This exclusive Mathews feature is of utmost importance to a smoothly functioning system. It permits a hydrant broken in a traffic accident to be removed and a spare put in its place. These two operations can be done *without excavating* and with only a few minutes' loss of neighborhood fire protection.

MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves



Mathews Modernized Hydrants offer these advantages

Easily maintained because simple in construction • Stuffing box cast integral with nozzle section • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle levels raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • Available with mechanical joint pipe connections • A modern barrel makes an old Mathews good as new

(Continued from page 96A)

of Dr. Charles Allen Thomas, one of the nation's leading atomic scientists, as president of the company.

Dr. Thomas, who was prominently identified with the production of the atomic bomb and co-author of a plan for control of neuclear weapons, was chosen by Monsanto's Board of Directors, and took office May 1. The 51-year-old scientist replaces William M. Rand, who retires under the company pension plan.

Dr. Thomas, who has been Monsanto's executive vice president since 1947, began his industrial career with General Motors, aiding in the development of ethyl gasoline and later established research laboratories in Dayton, Ohio. The laboratories were acquired by Monsanto in 1936 and Dr. Thomas became the company's research director. He then moved up through successive positions to the presidency.

High Pressure Gate Valves

704

R-P&C Valve Division, American Chain & Cable Co., Inc., Reading, Pa., has designed a Forged Steel Gate Valve for the high pressure field. The company states that among its features are a bolted bonnet, which insures maximum service life and low cost maintenance, tongue and groove joint with soft iron gasket to assure tightness under varying service conditions and extremely hard wedge facing that minimizes seizing, galling and abrasive wear. Stainless steel gland bolts and nuts prevent freezing or corrosion while the two piece gland and follower applies uniform pressure on packing—will not bind on stem.

The R-P&C Forged Steel Valve is available in sizes of ¼, ⅜, ½, ¾, 1¼, 1½, and 2 inch.

WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE •
FLANGE PIPE •
MECHANICAL JOINT PIPE •
FLEXIBLE JOINT PIPE •
SPECIAL CASTINGS •
SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specification. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
55 LIBERTY ST. — N. Y. C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

Mathieson Appoints Carr Technical Service Manager

Mathieson Chemical Corp., New York, N.Y., has announced the appointment of Ralph L. Carr as manager of the technical services department. He will report to Dr. George P. Vincent, director of product development.

Mr. Carr is the author of numerous papers and booklets on ammonia, caustic soda and chlorine.

High Lift Crawler Tractor

705

Mead Specialties Co., Chicago, Ill., has announced a new Model M-6 crawler tractor with the High-Lift feature. The new model has a two-speed transmission, final drive running in oil, fully shielded bogey carriage and spring loaded front idler wheels.

Its small size and maneuverability, pivoting within its own length, makes it a labor saving tool for loading mixers, small trucks, back-filling trenches, ditching, weed control and leveling operations where larger machines cannot work.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

CONCRETE PIPE

Gives you Strength, Durability and Economy in . . .

SANITARY SEWERS

For more than 100 years sanitary engineers have selected and specified concrete pipe for sanitary sewers because it meets all three essential requirements: (1) strength to resist severe impact and to sustain heavy overburdens, (2) durability to render many long years of heavy-duty service and (3) true *low-annual-cost* economy.

STORM SEWERS

Concrete pipe renders outstanding service in storm sewers because it carries off water efficiently. Its smooth, interior finish provides maximum hydraulic capacity and resists the wearing action of abrasive matter. Concrete storm sewer pipe is economical because it's moderate in first cost, has a long life and little or no maintenance cost. That's *low-annual-cost* service.

WATER LINES

Concrete pipe is ideal for water lines because (1) it can be designed to resist high internal pressures, (2) its joints can be made watertight, (3) there is no tuberculation and far less incrustation to impair hydraulic capacity and (4) it minimizes taste, odor and dirty water difficulties. Its reasonable first cost, combined with low upkeep and long life, give *low-annual-cost* service.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete—through scientific research and engineering field work

R. W. Hooker Elected Director A. F. C. A.

Hooker Electrochemical Co., Niagara Falls, N.Y., has announced that R. W. Hooker, vice-president in charge of sales for the company, has been elected a director-at-large of the Armed Forces Chemical Association. Mr. Hooker is a charter member of the association and the Hooker Company is one of nine sustaining members of the association.

Atlas Mineral Expands Texas Plant

The Atlas Mineral Products Company, Mertztown, Penna., has announced further expansion of the company's Houston, Texas Plant. According to George L. Wirtz, President of the company, the new construction will include a modern lining shop and storage facilities which will give the Gulf States' industry the most modern and best equipped lining shop in the Southwest.

Sheet rubber stock based on a large number of natural and synthetic rubber compositions will continue to be calendered at the Mertztown, Penna. Plant, but all types of linings will be installed at the Texas Plant.

SAFETY ALWAYS COMES FIRST!

BUILDERS VISIBLE FLOW CHLORINIZERS give you safe service at all times. Four big "safety factors" are built into these dependable chlorine gas feeders . . .

★ **SAFETY** insured by the powerful, spring-loaded chlorine control valve which closes instantaneously if any condition interferes with safe operation, including failure of water supply or breakage of any part of the vacuum system.

★ **SAFETY** insured because the system is under vacuum from control valve to injector inlet — no danger of chlorine escaping into operating room.

★ **SAFETY** insured by the float-actuated relief valve and automatic exterior exhaust outlet.

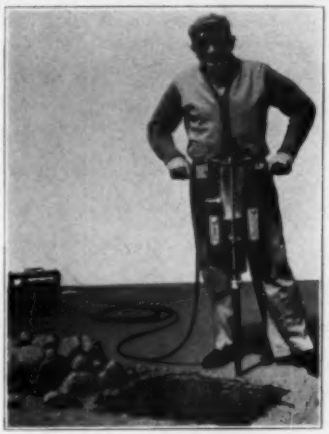
★ **SAFETY** insured because operating personnel are not subjected to tray-produced chlorine odors.

Available in three volumetric models — for any chlorination service:

Up to 400 lbs./day	Model DVSX	Bulletin 840-F2A
Up to 2000 lbs./day	Model CVS	Bulletin 840-F1
Up to 6000 lbs./day	Model HCVS	Bulletin 840-G27

For Bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Ave., Providence 1, R. I.

BUILDERS PROVIDENCE Instruments



Portable Gasoline Hammers

706

Barco Manufacturing Co., Chicago, Ill., has introduced the improved models of Barco Portable Gasoline Hammers, which features new ignition, greater portability, and increased operating convenience.

A number of advantages are claimed for these new models. The new coil-vibrator-condenser assembly weighs only a few ounces. It replaces a coil several times heavier and larger which formerly was a separate part connected to the hammer by heavy cable.

By locating the coil in the handle, the length of the high tension lead is reduced from ten feet to about five inches thereby making for better ignition. Also, the vibrator is a continuous vibrating type, not dependent on time point contact, which insures a faster initial spark and quick, easy starting under all weather conditions.

Infilco Completes Tucson Move

Infilco Inc., Chicago, Ill., and Tucson, Ariz., has completed the removal of its executive and engineering offices to Tucson, Arizona with the establishment of its advertising de-

(Continued on page 102A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

TENNESSEE CORPORATION

Ferri-Floc

FERRIC SULPHATE

TURBIDITY

Ferric Salts have proven their ability to coagulate water of widely varying turbidity. Spring rains will bring about turbidity for those who must treat surface supplies. The use of Ferri-Floc will simplify the treatment of this high turbidity. Ferri-Floc is a partially hydrated Ferric Sulphate that has the ability to convert these high turbidities without radical dosage changes.

A large filration plant superintendent has this to say, "For coagulation of high turbidity with a high PH we have found ferric sulphate to be superior in all cases and we would not hesitate to recommend it."

SULPHUR-DIOXIDE

HIGHEST QUALITY

SO_2

Sulphur Dioxide is effectively used in water treatment to remove objectionable odors remaining after purification.

TENNESSEE CORPORATION

INVESTIGATE

BULKLEY, DUNTON PULP CO.

COLLOIDAIR

DISSOLVED AIR FLOTATION SYSTEMS

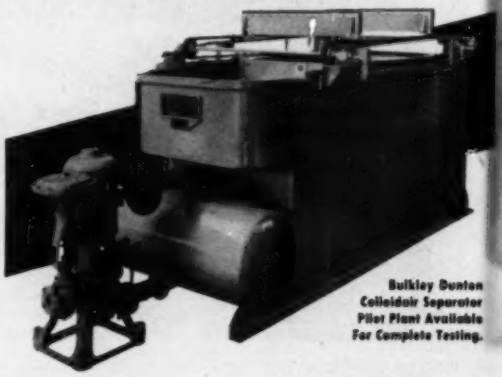
For Your Problem of:

SUSPENDED SOLIDS SEPARATION

A totally new process for high efficiency separation of—suspended solids • oils and greases • recoverable by-products • industrial wastes — from process or effluent flows.

Leading industries are utilizing this newest high efficiency-low space requirement method to economically—

- Recover at a profit former waste materials
- Recover water for reuse
- Control stream pollution
- Augment existing facilities



Bulkley Dunton Colloidair Separator Pilot Plant Available For Complete Testing.

- Meat packing
- Paper manufacture
- Chemical production
- Carbon separation
- Soap manufacture
- Petroleum refining
- Petroleum production
- Railroad maintenance
- Fruit & vegetable canning
- Automotive industry
- Leather & tanning
- Glue & gelatin manufacture
- Beet & cane sugar refining
- Fish canning
- Wine distilling

For further information please write

BULKLEY, DUNTON PULP CO., INC.

ENGINEERING DIVISION

295 Madison Avenue, New York 17, N.Y.
Pacific Coast: Security Bldg., Pasadena 1, Cal.

(*Continued from page* 100A)

partment at that location under Norman H. Tripplehorn.

Tripplehorn assumed the post of advertising manager, April 1st, 1951, following extensive experience in national technical advertising. Originally from Detroit, he has been active for 20 years as account executive and copy writer with leading advertising agencies.

Infilco factories and laboratories remain in Chicago, where the company has been located for 58 years. Engineering, sales and advertising functions are all now being administered from the new Tucson office.

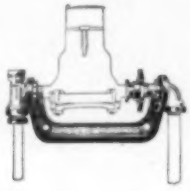
Haller Joins Builders

Builders Iron Foundry, Providence, R.I., has announced the appointment of Leo J. Haller as Sales Engineer in the Pittsburgh Branch office of the company and its associates, Builders-Providence, Inc., Omega Machine Co., and Proportioneers, Inc.

Mr. Haller, a graduate of the University of Pittsburgh, has previously been a sales engineer with the Superior Valve and Fitting Co., and a practice engineer with the Jones & Laughlin Steel Co., both in Pittsburgh. In the latter position he was assigned to equipment, maintenance, and repair. Mr. Haller is a member of the Association of Iron and Steel Engineers.

a Ford Yoke

for EVERY SETTING



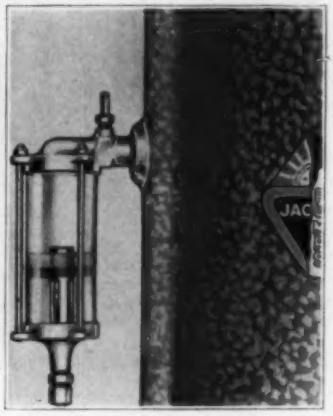
Ford Yokes are made in styles to meet every meter setting condition—indoors or out. Regardless of location, the Ford Yoke makes settings easier, removes pipe strains, saves labor and keeps meter connections permanently aligned for fast changes. Roughly, Ford Yokes are made in three styles:

1. Riser Yokes, to use where the meter must be raised above the service line.
2. Angle Yokes, to satisfy a vertical inlet, horizontal outlet condition.
3. Straight Line Yokes, for setting meters in a horizontal line without raising the level of the meter.

Every Ford Yoke is permanently satisfactory. Send for full information.

FOR BETTER WATER SERVICES — FORD

THE FORD METER BOX COMPANY, INC. Wabash, Indiana



Water-Logging Eliminator

707

Jacuzzi Bros., Inc., Richmond, Calif., has perfected a small inexpensive attachment to eliminate "Water-logging" in water system pressure tanks.

The device forces air into the tank as it is needed to provide a proper air cushion for satisfactory pump operation. This Jacuzzi "Supercharger" automatically maintains a proper balance between the air and the water in the tank, prevents frequent starts and stops of the pump, allows more water to be pumped during each pumping cycle, eliminates tank draining, reduces power bills and causes no reduction in water pressure.

The Supercharger can be installed with any kind of pump, regardless of make, and varies in size to fit any size pressure tank.

Chain Belt Elects McKnight

Chain Belt Co., Milwaukee, Wis., announces the election of L. B. McKnight to the newly created position of Executive Vice President of the Company.

Mr. McKnight has served in various managerial capacities since join-

(*Continued on page* 104A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

IN PIPE LINE CLEANING FROM MAINE TO CALIF., ITS...

CALIFORNIA...

"FLEXIBLE"

"Flexible" Power Drive & Propeller Tools Bid Heavy Scale From 12-Inch Waste Water Line In Calif. Refinery.
MAINE...
"Flexible" Power Bucket Machine At Work In City Sewer Line, Sanford, Maine. Five Cubic Yards Of Rock And Sand Removed From One Line Alone!

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

"FLEXIBLE"

UNDERGROUND PIPE CLEANING CO. — SEWER-ROD EQUIPMENT CO.

9059 VENICE BOULEVARD, LOS ANGELES 34, CALIFORNIA

41 Greenway St., Hamden 14, Conn.
147 Hillside Terrace, Irvington, New Jersey
2745 Mateur St., Dallas, Texas
P.O. Box 465, Memphis, Tenn.
1115 Delaware Ave., Fort Pierce, Florida
1212 Board of Trade Bldg., 141 West Jackson Blvd., Chicago 4, Ill.
200 Magee Building, Pittsburgh 22, Penn.
9 South Clinton St., Chicago 6, Ill.
29 Cordon Ave., Roslindale 31, Mass.
801 East Excelsior Blvd., Hopkins, Minn.
3786 Durango St., Los Angeles 34, Calif.
4455 S. E. 24th St., Portland, Oregon
351 West Jefferson Blvd., Room 614, Dallas, Texas

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. — P. O. BOX 14

MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—Nation Wide Service—30 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years by Dixie Tank and Bridge Company. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

COPYRIGHT 1949

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

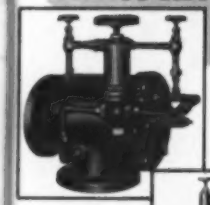
3 Good Ways to Insure

★ Longer Service

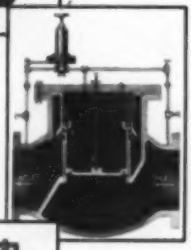
★ Minimum Maintenance

★ Greater Dependability

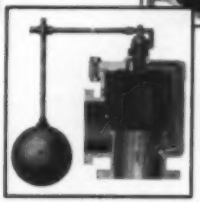
Install GOLDEN-ANDERSON "Cushioned" VALVES



G-A Surge Relief Valve. Bulletin W-2 sent on request.



G-A Water Pressure Reducing Valve. Bulletin W-3 contains the technical information you want.



G-A Cold Water Float Valve. Bulletin W-5 will be of interest to you.

The patented air and water double cushioning feature inherent in all G-A Valves prevents any slam or hammer.

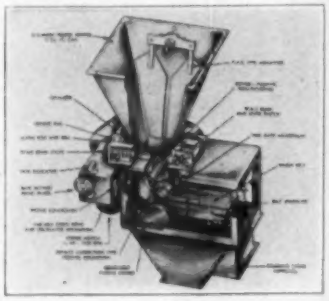
Let our reputable engineers help you with your water control problems.

GOLDEN ANDERSON Valve Specialty Company

2875 KEENAN BUILDING PITTSBURGH 22, PA.

(*Continued from page* 102A)

ing the Company in 1927 and has been Vice President and Director since 1948. He is currently President of the National Association of Conveyor Equipment Manufacturers and is also a member of the Conveyor Industry Advisory Committee to the National Production Authority.



Omega's New Chemizer

708

Omega Machine Co., Providence, R.I., has introduced a new dry chemical feeder.

Known as the Chemizer, this new feeder is small in size, but has a larger feeding capacity than many bigger feeders. It features continuous stream feeding at low or high rates, simplicity, compact design, easy installation, greater accessibility, ease of maintenance, infinitely variable feed rate, positive non-flood operation, and lower cost.

The Chemizer (Model 50-8) with an eight inch belt and a one foot weigh-span, will accurately and continuously feed and weigh from 5 to 5000 lb. of filter alum per hour; (other chemicals at relative rates, depending on bulk density).

Equipped with the Rotolock positive non-flood mechanism combined with the vibratory mechanism, the Chemizer uses the patented Omega wedge, which maintains the exact feed rate desired without electrical relays and without energy or work from the scale.

The feeder will handle all kinds of dry chemicals actually weighing the material fed; a five figure register reads in pounds fed; an over-or-under feed alarm is standard equipment and is constructed of stainless steel when available or on D.O. order.

Dravo Appoints Mason

Dravo Corporation, Machinery Division, Pittsburgh, Pa., has announced the appointment of Erwin S. Mason, Jr., as sales engineer for the Machinery Division in the Cincinnati, Ohio, territory. His office will be in the

Tegul MINERALEAD®

HYDRORINGS

HYDROPAC

GK sewer jointing compound

A complete line of jointing materials and accessories for water and sewer pipe. Specific bulletins and Technical Service available to help solve your problems.

Write 24 Walnut Street, Mertztown, Pa.

Over a half century of service

Atlas MINERAL PRODUCTS COMPANY

MERTZTOWN PA HOUSTON TEXAS

INSURE YOUR FILTER

AT NO COST

by using our

FILTER SAND and GRAVEL

FOR WATER AND SEWAGE PLANTS

Close attention to detail by experienced men and new modern equipment insure both the quality and prompt shipment of all orders. Our method of shipping in bulk prevents mixing of sizes in transit.

SHIPMENT IN BAGS WHEN PREFERRED

Try us on your next order.

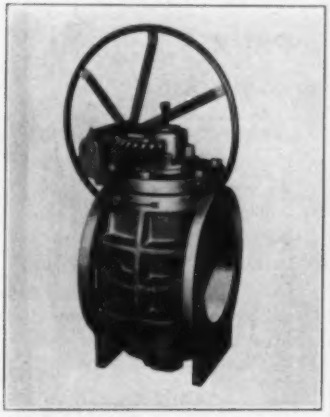
NORTHERN GRAVEL COMPANY

P. O. Box No. 307, Muscatine, Iowa

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Southern Ohio Bank Building, Cincinnati, according to W. R. Hoffman, Cleveland Manager for the company.

Mr. Mason, formerly vice president and secretary of Mason and Lowman Co., Cincinnati, will handle the sales of Dravo Heaters and products of the DeLaval Steam Turbine Co., C. N. Wheeler Division of the Hamilton Thomas Co., the Fuller Co. and Walker Process Equipment, Inc.



Worm & Gear Operated Plug Valves

709

Homestead Valve Mfg. Co., Coraopolis, Pa., have added Worm and Gear operated valves to the line of Homestead-Reiser lubricated plug valves.

The new valves have the patented "Self-Sealed" construction characteristic of all Homestead-Reiser Valves; port area equivalent to 100% of the area of standard pipe; are cast in semi-steel; and made in 8, 10 and 12 inch sizes.

According to the company, these valves will soon be available also in cast-steel, full-port type and in venturi type sizes up to 14 inches. In the venturi-type these valves will have face to face dimensions identical to those of like-sized series 15 wedge gate valves.

Hooker Appoints Springer

Hooker Electrochemical Co., Niagara Falls, N.Y., has appointed Donald E. Springer Assistant to the Chief Engineer, E. K. Newton.

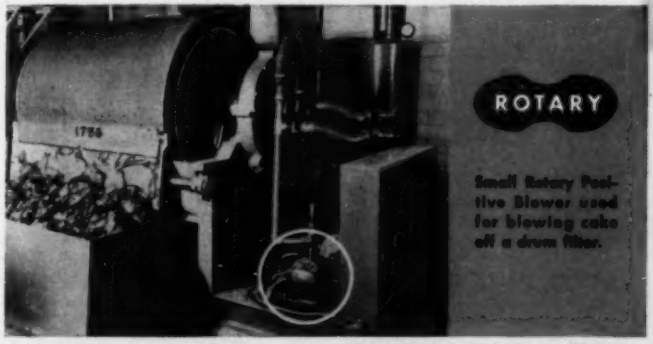
Mr. Springer has been with the company since his graduation from Iowa State College in 1936. Prior to his recent promotion, he was assigned to special projects among which was the design of the Hooker-Detrex plant at Ashtabula, Ohio which was placed in operation June 1950.

The superintendent of a large sewage treatment plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants—for metropolitan areas, rural villages or industrial sewage treatment—R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Mount Avenue, Connersville, Indiana



ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

THE LEOPOLD
GLAZED FIRE CLAY
TILE FILTER
BOTTOM

Check
These
Features!

• Low loss of head • Adaptable to any rectangular unit • Practically non-absorbent • Resists acid, alkali solutions • Long life • Equal filtration, distribution • Proved superiority.

Write for details!

F. B. LEOPOLD CO. INC.
2413 W. Carson St., Pittsburgh 4, Pa.

KEEP
PUMPS PRIMED
FOR INSTANT USE

No. 2V—APCO PRIMER

WITH V-APCO
AUTOMATIC PRIMER
OR
APCO TANK PRIMERS

AIR RELEASE VALVES
AIR & VACUUM VALVES

VALVE & PRIMER CORP.
356 W. HURON STREET
CHICAGO 10, ILL.

Literature and Catalogs

Fundamentals of Electrochemical Measurements

710

Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has published a comprehensive 24-page bulletin covering **Fundamentals of Industrial Electrochemical Measurements and Automatic Control.**

The bulletin presents measurement and control background for electrochemical measurements of pH, Oxidation-reduction potential and electrolytic conductivity in A-B-C language.

Section I of the bulletin covers the basic concepts of chemistry used in electrochemical measurements and acquaints the readers with such terms as ions, neutralization, and buffer actions.

Sections II, III, and IV are not intended to cover in detail the commercially available equipment for the measurements discussed, nor the installation and maintenance of the equipment in application. Rather, these sections give the background, definitions, theory, basic operating principles and practical applications of Hydrogen Ion Concentration (pH), Oxidation-Reduction Potential, and Electrolytic Conductivity.

Section V gives a brief summary of the final control elements commonly used in automatic control systems for the measurements discussed and will be seen to apply equally to all such measuring systems. As for the sections preceding this last one, the bibliography of articles and other literature available should prove of value to those wishing to pursue the subject in more detail.

Water Treatment and Conditioning

711

Brooks Chemicals, Inc., Cleveland, Ohio, has published a 16-page booklet on **Water Treatment and Water Conditioning.** The booklet gives considerable technical data and describes Brooks Services, products and methods employed in solving the many water problems encountered in industries, institutions and governmental works.

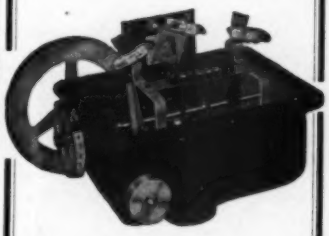
According to the booklet, the Brooks water treatment service is divided into the following seven categories: 1) Boiler Water Treat-

Every bag of
BOND-O Homogenized
is a bag of
perfect jointing
compound

BOND-O's exclusive machine blending process brings you the *one* flawless self-caulking jointing compound. The finest basic materials obtainable are so thoroughly blended by the BOND-O process—that you are assured of absolute uniformity of performance from every bag you buy.

NORTHROP & COMPANY, INC.
SPRING VALLEY NEW YORK

ROTO-TROL



RF-2
WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION
HEALY-RUFF COMPANY
751 HAMPDEN AVE., ST. PAUL 4, MINN.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

ments, 2) Water line Treatments, 3) Cooling Water System Treatments, 4) Brine System Treatments, 5) Waste Water Treatments, 6) Zeolite Softener Treatments, and 7) Consulting Service.

Included in the booklet is a study of ten impurities common in water, the damage they cause and how to combat them.

Water Measuring Equipment

712

Sparling Meter Company, Los Angeles, Calif., has just published an attractive 20-page, two color catalog on **Main Line Water Measuring Equipment.**

The catalog, profusely illustrated with photographs and drawings, covers all types of main line meters such as, cast screw tubes, flanged tube meters, bell and spigot meters, saddle type meters, concrete and wood pipe meters, salt water, high pressure, fire hydrant meters, and compound meters.

Featured on page 9 is the new Sparling Hydrovalve. According to the catalog, the Hydrovalve is a water-balanced valve that opens and shuts by line pressure. Perfect control of the main-line flow can be obtained with the Hydrovalve by simply turning a knob with the thumb and finger.

The center spread of the catalog contains typical accuracy and head loss curves for compound meters, covering meters from 2 to 72 inches. Photographs, diagrams and text on Sparling instruments and controls complete the catalog.

Sewage Equipment

713

Chicago Pump Company, Chicago, Ill., has made available a 2-color folder on **Chicago Sewage Equipment.**

Photographs for each piece of equipment are shown and the folder discusses the company's Aer-Degritter, Comminutor, "Pakage" Sewage Plant, Pontoon covers and gas holders, Swing Diffusers and Precision Diffuser Tubes, Standardaire Blower, Flush-Kleen Ejectors and Scrupeller Sludge Pumps.

pH Defined

714

Allis-Chalmers, Water Conditioning Department, Milwaukee, Wis., has just released a new informative leaflet entitled **"The Meaning, Application and Measurement of pH."**

WATER WORKS PREFER

climax POWER

Selma, Alabama
Aurora, Illinois
Concord, North Carolina
Negaunee, Michigan
Akron, Ohio
Cedar Rapids, Iowa
Centralia, Illinois
Benton Harbor, Michigan
Oshkosh, Wisconsin
Moline, Illinois
East Orange, New Jersey
Tipton, Iowa
Antigo, Wisconsin
Monticello, New York
Springfield, Massachusetts
Ft. Worth, Texas
Quincy, Illinois
Michigan City, Indiana
Elgin, Illinois
Superior, Wisconsin
Dubuque, Iowa
Tonowanda, New York
Statesville, North Carolina
...ton, Iowa
Carey, Ohio
New York, New York
Aberdeen, South Dakota
Haverhill, Massachusetts
Bedford Park, Illinois
Elkhart, Indiana
Waterloo, Iowa
Wilmington, North Carolina
Holland, Michigan
Provo, Utah
Evanston, Illinois
Indianapolis, Indiana
Alliance, Ohio
Burlington, Iowa
Highwood, Illinois
Baton Rouge, Louisiana
Rockhill, South Carolina
Newton, Kansas
Amherst, Iowa
Goshen, Indiana
Mankato, Minnesota
Canal Winchester, Ohio
...ld, Massachu...
...l, Indiana
...ton, Ohio
..., Alabama
..., Michigan
..., New York
...e, Louisian
..., Wiscons

WE are gratified that during the past years a growing number of municipal water works have approved and prefer Climax Engines for standby service. A few of the many are listed above.

WATER WORKS Climax engines provide dependable power to meet all emergency demands. Many of above installations have rendered reliable service over periods exceeding 15 years. Sizes 40 to 600 H.P.

For complete information and service records of Climax Engines for Water and Sewage Works write to Climax Engine and Pump Mfg. Co, 208 S. La Salle Street, Chicago, Illinois.

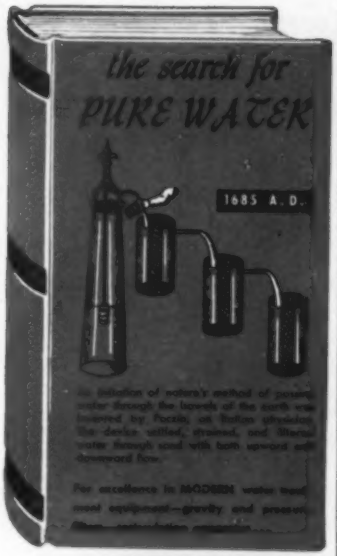
climax

ENGINE AND PUMP MFG. CO.

Factory and General Office Clinton, Iowa

Regional Offices Chicago - Dallas - Long Beach, Cal.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.



MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.
607 Columbia Ave.
Darby, Pa.

"Since 1885"
Sewage and Garbage Shredders
Detailed Specifications and suggested Installation Drawings furnished
GRUENDLER
CRUSHER & PULVERIZER CO.
ST. LOUIS 6, MO.

STOP WATER SEEPAGE SEWAGE CORROSION
WITH FORMULA No. 640
a clear liquid penetrating (1"+) sealer for concrete and masonry preventing water absorption and reducing the action of acids. Holds 15' hydrostatic head. Use our Hayproc Rubberized Enamel for color on walls and floors—not affected by concentrated acids, alcohol, oil, or traffic abrasion.
30 OTHER PRODUCTS
Write for technical data.
Haynes Products Co., Omaha 3, Nebr.
See our file in Sweet's

The leaflet is simple, concise and non-technical in the treatment of its subject matter and tables reproduced show the different pH values of common acids and alkalies, the intensity of acidity or alkalinity, and the most desirable pH range of industrial water for different conditions and applications.

Venturi Ball Valve

715

Paul Valve Corporation, New York, N.Y., has released a bulletin on Paul Valves that features the **Paul Venturi Ball Valve.**

The bulletin states that the ball valve features a precision-ground ball, actuated by the exclusive Paul venturi-ball principle to provide accurate control at all positions from wide open to tight shut.

A large size cut-away view of the guide and lock, accompanied with a series of action drawings shows the complete principle of operation of the valve along with the four different types of Paul valve yoke members. Operational methods, liquid flow chart, engineering data, and other types of valves complete the bulletin.

Some of the advantages claimed for the valve are, straight-through flow, easy to open and close, smooth throttling, self-cleaning and purging, and long life.

Hydraulically Powered Controller

716

Builders-Providence, Inc., Providence, R.I., has announced a new bulletin on **Controllers,** Hydraulically Powered Models RCA and RCB. This bulletin describes these units, and in addition gives dimension tables and a typical installation diagram.

Also presented are discussions of applications and installation of these controllers for wash water service, raw water service, sewage plant flow control, clear well level shutoff, master and level control and special problems.

Among the features listed for these controllers are high control accuracy, ease of adjustment, simplicity of design, minimum space requirements, low head loss, long life accuracy, and automatic control.

Tank Pressure Control

717

Automatic Control Co., St. Paul, Minn., has just published a bulletin on **Autocon Multi-pump Duotrols**

Phipps & Bird
LABORATORY MIXER
IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va

ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All-Purposes
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.
All correspondence regarding sales and engineering should be addressed to:
PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

STOP
JOINT LEAKAGE
USE
CARSON CLAMPS
With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.
Write for Prices.
Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

Superintendent of Operation for municipal water system
with experience in operation and maintenance of chlorinators, pumping stations, deep wells; installation of copper service connections; meter maintenance and testing. Ecuador, South America. Minimum 2 year contract, salary $8400. Send experience records, references, etc. Suite 52, 1737 H. Street, N.W., Washington, D.C.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

that tells how to get more water with fewer pump operations from any pressure tank having two or more pumps.

Illustrations show how the combined pressure and float units of the Autocon Duotrol operate in horizontal pump installations or in deep-well installations. It tells how much more water can be obtained from a pressure tank while greater pressure stability is permanently maintained.

The bulletin emphasizes that the control reduces the number of pump operations, resulting in power savings and lower maintenance costs, and positively protects a pressure tank from water-logging or from air-binding. Also included are helpful tables, together with specification data.

Block Underdrains for Trickling Filters

718

National Fireproofing Corporation, Pittsburgh, Pa., has just published a very informative 16-page bulletin on Natco Unifilter Block Underdrains.

Photographs and complete dimentional drawings show all the different types, and shapes and sizes of Natco Salt Glazed Unifilter Blocks. Included are photographs and descriptions of actual installations in varying stages of construction, showing methods of laying blocks.

Designs and complete plans for trickling filters are also included in the bulletin.

Water Works Catalog

719

B. James Robertson Co., Pasadena, Calif., have published a catalog on **Water Meter Parts and Water Works Supplies.**

The catalog covers their complete line of supplies and equipment and includes, pipe benders, wrenches, meter discs, meter base spreader, pipe locators, meter repair tools, etc.

Also described is the company's DRP (Disc Reclaiming Process) in which they state that warped and damaged water meter discs can be completely reclaimed and returned to service at a fraction of the cost of a new disc.

Floating Roof Tanks

720

Hammond Iron Works, New York, N.Y., has just published a bulletin illustrating and giving detailed information on three types of **Floating Roof Tanks** for product

CEMENT GUN COMPANY MAKES POOL "BETTER THAN EVER" WITH GUNITE

Top photograph shows marked disintegration and almost complete failure of a large Municipal Swimming Pool located in a Virginia city.

This picture was taken after Cement Gun Company crews had begun restoration with "Gunite." Reinforcing mesh is in place on the floor and chipping and scaling operations are taking place on the sidewalks.

Lower photograph shows the complete "Gunite" job before water was put back in the pool. This job is typical of what Cement Gun Company can do with disintegrated concrete and masonry using "Gunite."

Scores of similar "Gunite" jobs we have performed are illustrated and described in Bulletin (c)2400. Write today, on your letterhead, for a free copy.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

TWELVE STORIES OF SPACIOUS COMFORT
LIMITED TO 500 GUESTS

AT THE HEART OF NEW YORK'S SMART SHOPPING CENTER!

Enjoy the hospitality of a wayside inn at this modern ideally located hotel.

EVERY ROOM WITH PRIVATE BATH AND SHOWER

Near Penn. Station and all points of interest.

Air-Conditioned restaurants and cocktail lounge

OPPENHEIM COLLINS

R. H. MACY

SAKS

McCREERY

ALTMAN

GIMBELS

COLLINGWOOD

Just West of FIFTH AVE. on 35th St.

AL SCHWARTZ

A. LAWRENCE PRINCE Resident Manager

conservation and corrosion resistance.

According to the bulletin, these tank roofs are the most efficient and most generally used, as they provide insulation of the entire surface of the liquid in the tank to substantially reduce the possibility of corrosion and product losses due to boiling, breathing and filling.

It is further stated that the pontoon design floating roof utilizes a minimum of material to achieve the maximum in roof bouyancy and is recommended for tanks having a diameter of 50 feet or more. A short description of the other products made by Hammond complete the bulletin.

Water Control

721

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has just released a new folder humorously titled **"Water Control Problems Vanish When You Count To 7."**

The folder contains a quick practical answer as to how the problems of controlling or regulating water can be found in 7 days by the use of Armco Gates. Easy operation, long service life, adaptability, and low cost are listed as several of their features which have resulted in wide use of Armco Gates in water supply, sewage, irrigation, flood control and drainage.

Photographs show typical applications of some of the twenty-seven different models of Armco Gates.

Raw and Waste Water Treatment

722

Philadelphia Quartz Co., Philadelphia, Pa., has made available a 12 page booklet covering **Treatment of Raw and Waste Waters.** The booklet includes the latest technical and chemical knowledge on the use of silicate of soda in the preparation of activated silica sols used as coagulant aids in nearly all phases of water treatment, such as treating raw water, waste water, industrial salvage and process waters.

The illustrated booklet discusses in detail improved floc formation with activated silica sol in various waters, with actual plant figures on turbidities, color removal, filter runs and savings. Included also are winter coagulation; lime-soda softening; the preparation of N-Sol Processes by batch and continuous systems; and test procedure for pre-plant-use calculations.

Blowers

723

Standard Stoker Company, Inc., Erie, Penna., has recently issued a bulletin on the **Standardaire Blower.** The bulletin discusses complete dimensional information that includes, engineering layout, typical application data, important design data, blower number and ratings CFM at listed RPM.

Photographs of the blowers, line drawings and cutaway dimensional drawings cover the complete line of blowers along with a list of accessories.

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.

GATE OPERATORS — PORTABLE — FOR STANDS & UNDERGROUND GATES—MOTOR TRUCK MOUNTED

PAYNE DEAN & CO.
CLINTON, CONN.

SERVICING
FEDERAL
STATE
COUNTY
MUNICIPAL
AND
INDUSTRIAL WATER TOWERS

SPEELMON ELEVATED TANK—SERVICE

COMPLETE PAINTING AND REPAIR SERVICE

822 N. Court St. Rockford, Ill.

PAINTS OVER RUST!

RUSTREM STOPS RUST!

No priming, scraping, brushing

Rustrem paints right over rust. For stacks, fire escapes, Bridges, fences, flashings, all metal. Farm, auto, marine, machinery. Black, aluminum, clear.

SPECO, Inc. 7308 Associate Ave. Cleveland 9, Ohio

Water & Sewage Works Subscribers

We need back issues of January, March and May, 1951. For every copy returned to us in good condition we will allow one additional month on your subscription, or will pay 20c cash per copy. Be sure to print your name and address on wrapper. Mail to—

W&SW Circulation Dept.
22 W. Maple St. Chicago 19, Ill.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

The great REFERENCE & DATA issue alone is worth more than the yearly subscription rate. In it you will find formulae, charts and illustrations covering information not obtainable in any other one source.

Supply of 1951 REFERENCE & DATA number is limited. If you are not a subscriber send your order today!

WATER & SEWAGE WORKS
22 West Maple Street
Chicago 10, Ill.

You may enter my order for 1 yr. @ $2.00 ☐
☐ Include R&D issue 2 yrs. @ $3.00 ☐
Check enclosed ☐

Send bill to .....
My title is .....
Address .....
City ..... Zone .....
State .....
(Add $1.00 per year for foreign postage)

- *If you are interested in the water field only you get all the authoritative data on this subject.*
- *If you are interested in sewage problems only you are kept fully informed and given much help in this field.*
- *If you are interested in both subjects you get all the information in this one monthly magazine.*

Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL, INC.
Consulting Engineers
Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants—Industrial Buildings City Planning—Reports—Valuations
Laboratory
121 South Broad Street, Philadelphia 2, Pa.

BLACK & VEATCH
Consulting Engineers
Water — Sewage — Electricity Industry
Reports, Design, Supervision of Construction, Investigations, Valuation and Rates
4706 Broadway, Kansas City 2, Missouri

CAPITOL ENGINEERING CORPORATION
Engineers—Constructors—Management
SEWAGE SYSTEMS — WATER WORKS
Designs and Surveys — Roads and Streets
Planning — Airports
Bridges — Dams
Executive Offices
DILLSBURG, PENNSYLVANIA

Alvord, Burdick & Howson
Engineers
Charles B. Burdick
Louis R. Howson
Donald H. Maxwell
Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation
Civic Opera Building — Chicago

Clinton L. Bogert Associates
CONSULTING ENGINEERS
Clinton L. Bogert — Ivan L. Bogert
J. M. M. Greig — Robert A. Lincoln
Donald M. Ditmars — Arthur P. Ackerman
Water & Sewage Works
Refuse Disposal — Industrial Wastes
Drainage — Flood Control
624 Madison Avenue, New York 22, N.Y.

The Chester Engineers
Water Supply and Purification—Sewage and Industrial Waste Treatment—Power Plants—Incineration—Gas Systems—Valuations — Rates — Management — Laboratory—City Planning
210 E. Park Way,
Pittsburgh 12, Penna.

MR. CONSULTING ENGINEER
Are you interested in both
WATER & SEWAGE
If so there is no better place for your professional card than in this dual interest magazine.
WATER & SEWAGE WORKS

Bowe, Albertson & Associates
Engineers
Water and Sewage Works
Industrial Wastes—Refuse Disposal—Municipal Projects
Airfields—Industrial Buildings
Reports—Designs—Estimates
Valuations—Laboratory Service
110 William St., New York 7, N.Y.

CONSOER, TOWNSEND & ASSOCIATES
Water Supply—Sewerage—Flood Control & Drainage—Bridges—Express Highways—Paving—Power Plants—Appraisals—Reports—Traffic Studies—Airports
351 East Ohio Street
Chicago 11, Ill.

JOHN J. BAFFA
Consulting Engineer
Water Supply and Treatment
Sewerage and Sewage Treatment
75 West Street — New York 6, N. Y.

Buck, Seifert and Jost
Consulting Engineers
(Formerly Nicholas S. Hill Associates)
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories
112 East 19th St., New York

DE LEUW, CATHER & COMPANY
Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation
Investigations — Reports — Appraisals
Plans and Supervision of Construction
150 North Wacker Drive, Chicago
79 McAllister Street, San Francisco 2, Calif.

Michael Baker, Jr.
The Baker Engineers
CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS
Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services—Surveys and Maps
HOME OFFICE—ROCHESTER, PA.

BURGESS & NIPLE
Civil and Sanitary Engineers
Water Supply and Purification
Sewerage and Sewage Treatment
Appraisals, Reports, Valuations
584 East Broad Street
Columbus 15, Ohio

Eckenfelder Associates, Inc.
Sanitary Chemists
Sewage and Industrial Waste Surveys, Process Research and Development, Water Analysis, Stream Pollution, Investigations, Laboratory Analyses and Reports
45 N. Broad Street — Ridgewood, N.J.

W. H. & L. D. BETZ
CONSULTING ENGINEERS
INDUSTRIAL WASTE
INDUSTRIAL WATER
ANALYSIS — DESIGN
INVESTIGATIONS — OPERATION
Gillingham & Worth Sts.
Philadelphia 24, Pa.

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. — Cleveland, Ohio
P.O. Box 7088 — 1404 E. 9th St.

Fay, Spofford & Thorndike
Engineers
Charles M. Spofford — Ralph W. Horne
John Ayer — William L. Hyland
Dion A. Bowman — Frank L. Lincoln
Carroll A. Farwell — Howard J. Williams
Water Supply and Distribution—Drainage
Sewerage and Sewage Treatment—Airports
Investigations and Reports
Designs — Valuations
Supervision of Construction
Boston — New York

Black Laboratories, Inc.
Consulting Engineers and Chemists
On all Problems of
Water, Sewage, and Waste Treatment
ANALYSIS-TREATMENT CONTROL
RESEARCH
968 South Oak Street
Gainesville, Florida

Camp, Dresser & McKee
Consulting Engineers
6 Beacon Street, Boston 8, Mass.
Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

Finkbeiner, Pettis & Strout
Carleton S. Finkbeiner, G. E. Pettis, Harold K. Strout
Consulting Engineers
Reports — Designs — Supervision
Water Supply, Water Treatment, Sewerage, Sewage Treatment, Wastes Treatment, Valuations & Appraisals.
518 Jefferson Avenue — Toledo 4, Ohio

Freese, Nichols and Turner
CONSULTING ENGINEERS
2111 NATIONAL STANDARD BUILDING
HOUSTON 2, TEXAS
CH-1624

Charles Haydock
Consulting Engineer
Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.
2314 Girard Trust Company Building
Broad Street and South Penn Square
Philadelphia 2, Pa.

Metcalf & Eddy
Engineers
Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields — Valuations
Laboratory
Statler Building, Boston 16

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
ENGINEERS
Pittsburgh, Pa. — Scranton, Pa.
HARRISBURG, PA.
Water Works, Sewage, Industrial Wastes & Garbage Disposal—Roads, Airports, Bridges & Flood Control. Town Planning, Appraisals, Investigations & Reports.

RICHARD HAZEN
Consulting Engineer
Municipal and Industrial Water Supply and Treatment
Sewage and Waste Disposal
Reports, Design, Construction, Operations
110 East 42nd Street, New York 17, N. Y.

Nussbaumer, Clarke & Velzy, Inc.
Newell L. Nussbaumer—Irving Clarke—Charles R. Velzy
Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning
52 Vanderbilt Ave., N. Y. City
327 Franklin St. — Buffalo, N. Y.

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
Investigations and Reports
New York — Reading, Pa. — Washington
Houston — Philadelphia

HITCHCOCK & ESTABROOK, Inc., LESTER D. LEE, Associate
Professional Engineers and Architects
Consultants to Municipalities since 1920
WATER, SEWERAGE, PAVING, POWER PLANTS, AIRPORTS, REPORTS AND APPRAISALS
21 S. Third Street
Minneapolis, Minnesota

WATER WASTE SURVEYS
FOUNDATION & SOIL STUDIES
Load Tests — Borings
H. C. NUTTING CO.
CINCINNATI 26, OHIO

Ivan M. Glace
Consulting Sanitary Engineer
WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT
Design, Construction and Supervision of Operation
Telephone 6-5407 — 1901 North Front St. Harrisburg, Pa.

The Jennings-Lawrence Co.
C. C. Walker — F. L. Swickard
B. I. Sheridan — R. L. Lawrence
Civil & Municipal Engineers
Consultants
Water Supply, Treatment & Distribution
Sewers & Sewage Treatment
Reports — Design — Construction
12 N. Third Street — Columbus 15, Ohio

PARSONS, BRINCKERHOFF, HALL & MACDONALD
G. Gale Dixon, Associate
ENGINEERS
Dams, Water Works, Sewerage, Airports, Bridges, Tunnels, Traffic & Transportation Reports, Highways, Subways, Foundations, Harbor Works, Valuations, Power Developments, Industrial Buildings
51 Broadway, — New York 6, N.Y.

WILLIAM A. GOFF, INC.
General Engineering and Consulting Services—Water, Sewerage, Refuse Incineration, Industrial Buildings, Power Plants, Airport, Town Planning Plans, Supervision, Valuations, Reports
1321 Arch Street — Philadelphia 7, Pa.

Jones, Henry & Schoonmaker
(Formerly Jones & Henry)
Consulting Sanitary Engineers
Water Works
Sewerage & Treatment
Waste Disposal
Security Bldg. — Toledo 4, Ohio

Malcolm Pirnie Engineers
Civil & Sanitary Engineers
Malcolm Pirnie — Ernest W. Whitlock
G. G. Werner, Jr.
Investigations, Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates
25 West 43rd St., New York 18, N.Y.

GREELEY AND HANSEN
Engineers
Samuel A. Greeley — Paul Hansen (1920-1944)
Paul E. Langdon — Kenneth V. Hill
Thomas M. Niles — Samuel M. Clarke
Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
220 S. State Street, Chicago 4

Engineering Office of CLYDE C. KENNEDY
COMPLETE ENGINEERING SERVICE
For More Than a Quarter Century
Investigations, Reports, Design, Supervision of Construction and Operation
Water Supply, Water Conditioning, Sewerage, Sewage and Industrial Waste Treatment
CHEMICAL and BIOLOGICAL LABORATORY
604 Mission Street — San Francisco, 5

THE PITOMETER COMPANY
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurements & Special Hydraulic Investigations
New York, — 50 Church Street

Havens & Emerson
W. L. Havens — C. A. Emerson
A. A. Burger — F. C. Tolles — F. W. Jones
Consulting Engineers
Water, Sewage, Garbage, Industrial Wastes, Valuations—Laboratories
Leader Building, Cleveland 14 — Woolworth Bldg., New York 7

Morris Knowles, Inc.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning
1312 Park Building, Pittsburgh, Pa.

LEE T. PURCELL
Consulting Engineers
Water Supply & Purification; Sewerage & Sewage Disposal; Industrial Wastes; Investigations & Reports; Design; Supervision of Construction & Operation
Analytical Laboratories
1 Lee Place — Paterson 1, N.J.

Hayden, Harding & Buchanan
Consulting Engineers
John L. Hayden
John H. Harding — Oscar J. Campia
Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural
810 Park Square Building, Boston, Mass.

WM. S. LOZIER CO.
Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal
Consulting Engineers
10 Gibbs Street — Rochester 4, N. Y.

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification, Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.
369 East 149th Street
New York 55, N. Y.

CONSULTING ENGINEERS

Specializing in the Field of
WATER AND SEWAGE WORKS

Continued

Benjamin L. Smith & Associates
Engineers
Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities
11 North Pearl Street
Albany 7, New York

Wertz Engineering Co., Inc.
Consultants, Designers & Constructors
Water Supply & Purification
Sewage & Industrial Waste Treatment
Stream Pollution Studies
Chemical & Bact. Laboratory Service.
441 North 2nd St. **Reading, Pa.**

ROBERT AND COMPANY ASSOCIATES
Architects & Engineers
• ATLANTA •
WATER SUPPLY • INCINERATORS
SEWAGE DISPOSAL • POWER PLANTS

STANLEY ENGINEERING COMPANY
Consulting Engineers
Water Works—Sewerage
Electric Power—Flood Control
Rate Studies—Valuations—Industrial
Airports . . . . . Municipal Buildings
Hershey Bldg., Muscatine, Ia.

Weston & Sampson
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service Supervision, Valuations
14 Beacon St. **Boston, Mass.**

Russell & Axon
Consulting Engineers
Geo. S. Russell F. E. Wenger
Joe Williamson, Jr.
Water Works, Sewerage, Sewage Disposal Power Plants, Appraisals
408 Olive Street **Municipal Airport**
St. Louis 2, Mo. **Daytona Beach, Fla.**

Alden E. Stilson & Associates
Limited
Consulting Engineers
Water Supply Sewerage Waste Disposal
Mechanical Structural
Surveys Reports Appraisals
209 South High St. **Columbus, Ohio**

Whitman & Howard
Engineers (Est. 1869)
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

J. E. SIRRINE Company
Engineers
Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses
Greenville **South Carolina**

Phillip B. Streander & Affiliates
Consulting Engineers
132 Nassau Street, New York 7, N.Y.
885 Atlantic Avenue, Boston 11, Mass.
Water Supply, Treatment, Distribution
Trade Wastes, Refuse Disposal
Sewerage, Sewage Treatment
Plans, Supervision, Reports

WHITMAN, REQUARDT & ASSOCIATES
Engineers — Consultants
Civil—Sanitary—Structural—
Mechanical—Electrical
Reports, Plans, Supervision, Appraisals
1304 St. Paul Street
Baltimore 2, Maryland

INDEX TO ADVERTISERS

A
American Brass Co., The ... 10A
*American Cast Iron Pipe Co. ... 22A
*Anthracite Equipment Co. ... 108A
*Atlas Mineral Products Co. ... 104A

B
Bucyrus-Erie Hydrocrane Div. ... 33A
Buffalo Meter Co. ... 12A
*Builders-Providence, Inc. ... 108A
Bulkley, Dunton Pulp Co., Inc. ... 101A
Byers Co., A. M. ... 31A

C
Carlon Products Corp. ... 24A
Carson Cadillac Co. ... 108A
Cast Iron Pipe Research Ass'n. ... 6-7A
Cement Gun Co. ... 109A
Chapman Valve Mfg. Co. ... Second Cover
*Chicago Bridge & Iron Co. ... 9A
*Chicago Pump Co. ... 83A
Climax Engine & Pump Mfg. Co. ... 107A
Clow & Sons, Jas. B. ... 26A
Combustion Eng. Superheaters, Inc. ... 25A
Crane Co. ... 19A

D
Dixie Tank & Bridge Co. ... 103A
Dresser Manufacturing Div. ... 16A

E
Eddy Valve Company ... 21A

F
Fairbanks-Morse ... 11A
Filer & Stowell Co., The ... 90A
Flexible Sewer Rod Equipment Co. ... 103A
Ford Meter Box Co., Inc. ... 102A

G
General Electric Co. Disposall ... 14A
General Electric Co. ... 28-29A
*Golden-Anderson Valve Spec. Co. ... 104A
Gruendler Crusher & Pulverizer Co. ... 108A

H
Haynes Products Co. ... 108A
Healy-Ruff Co. ... 106A
*Hellige, Inc. ... 92A
Homelite Corp. ... 18A
Hotel Collingwood ... 109A
Hydraulic Development Co. ... 110A

I
*Industrial Chemical Sales Co. ... 23A
*Infilco Inc. ... 13A

J
*Jeffrey Mfg. Co. ... 15A

K
Keasbey & Mattison Co. ... 87A

L
Layne & Bowler, Inc. ... 20A
Leadite Co., The ... 92A
Leopold Co., F. B., Inc. ... 106A
Lumenite Electronic Company ... 84A

M
McDonald Mfg. Co., A. Y. ... Third Cover
*M. & H. Valve & Fitting Co. ... 94A
Mathieson Chemical Co. ... 4A
Morse Bros. Machinery Co. ... 96A
Mueller Company ... 32A

N
Neptune Meter Company ... 34A
Nordstrom Valve Div. (Rockwell) ... 93A
Northern Gravel Company ... 104A
Northrop & Co., Inc. ... 106A

O
*Omega Machine Co. ... 17A

P
Pacific Flush-Tank Co. ... 8A
Payne Dean & Co. ... 110A
*Permutit Co., The ... 89A
Phipps & Bird, Inc. ... 108A
Pittsburgh Coke & Chemical Co. ... 86A
*Pittsburgh-Des Moines Steel Co. ... 85A
Portland Cement Ass'n. ... 99A
*Proportioneers, Inc. ... 88A

R
Roberts Filter Mfg. Co. ... 108A
Rockwell Mfg. Co. ... 3A
Roots-Connersville Blower Corp. ... 105A

S
Speco, Inc. ... 110A
Spealmon Elevated Tank Service ... 110A

T
Tennessee Corporation ... 101A

U
U. S. Electrical Motors, Inc. ... 92A
*U. S. Pipe & Fdry. Co. ... 91A

V
*Valve & Primer Corp. ... 106A

W
Walker Process Equip. Co. ... 30A
*Wallace & Tiernan Co., Inc. ... Back Cover
Warren Foundry & Pipe Corp. ... 98A
Walsbach Corp., The ... 27A
Wood & Co., R. D. ... 97A
Worthington Pump & Mchy. Corp. ... 95A

*Advertisers with * were represented in the April, 1951 Convention and Data Edition with Catalog specifications copy. Please refer to that issue for additional information on behalf of their products.

EXCELLENCE OF QUALITY - - EFFICIENCY IN DESIGN

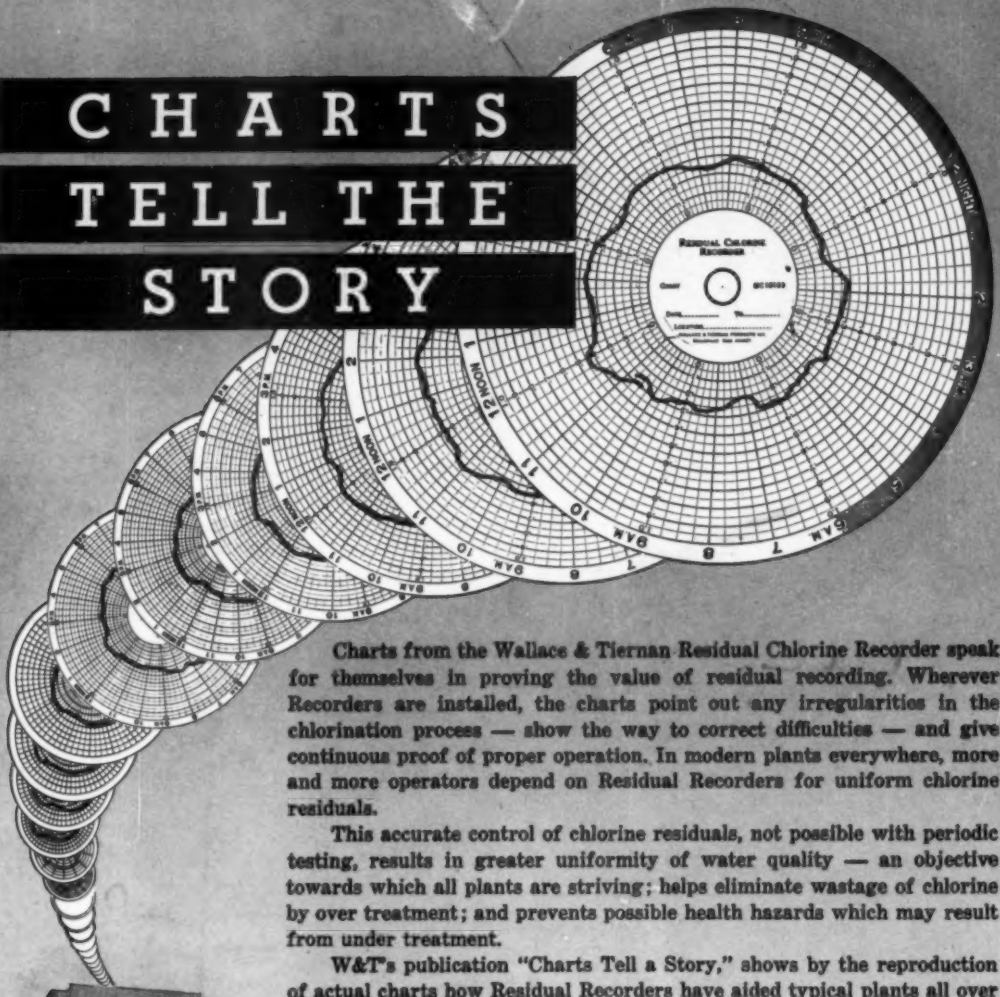
A tradition of superior craftsmanship with the most modern facilities produce McDonald Waterworks Brass. Above are three Corporation Stops: inlet end is Mueller threaded, outlet end, as shown, for threaded iron pipe, Mueller Service pipe thread for copper tubing, and with lead flange union coupling. Ask us for our illustrated brochure showing our complete line of Waterworks Brass. A. Y. McDonald Mfg. Co., Dubuque, Iowa.

EST. 1856

McDonald

BRASS GOODS • PUMPS • OIL EQUIPMENT

CHARTS TELL THE STORY



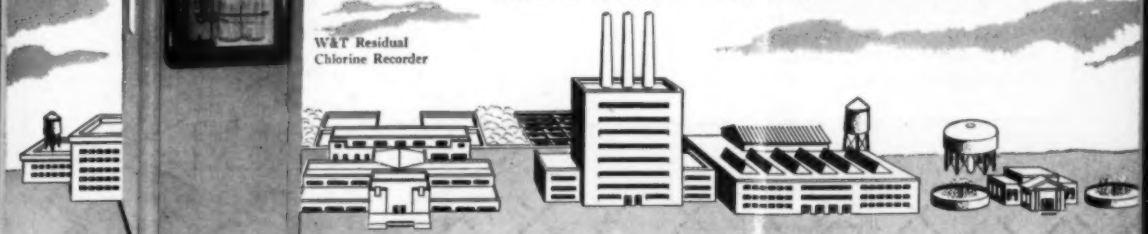
Charts from the Wallace & Tiernan Residual Chlorine Recorder speak for themselves in proving the value of residual recording. Wherever Recorders are installed, the charts point out any irregularities in the chlorination process — show the way to correct difficulties — and give continuous proof of proper operation. In modern plants everywhere, more and more operators depend on Residual Recorders for uniform chlorine residuals.

This accurate control of chlorine residuals, not possible with periodic testing, results in greater uniformity of water quality — an objective towards which all plants are striving; helps eliminate wastage of chlorine by over treatment; and prevents possible health hazards which may result from under treatment.

W&T's publication "Charts Tell a Story," shows by the reproduction of actual charts how Residual Recorders have aided typical plants all over the country.

Why not write for your copy today — or call your W&T Engineer — to see how residual recording can help in *your* plant, too?

W&T Residual Chlorine Recorder



WALLACE & TIERNAN COMPANY, INC.

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

S-64